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## **The Burden of Disability Among Active Duty Air Force Members**

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## PREFACE

This report is the summary of a contract effort conducted by North Carolina A&T State University, funded through the HBCU/MI (Historically Black Colleges and Universities/Minority Institutions) program. This report examined available statistics pertaining to disability within the United States Air Force (USAF) and identified numerous types and trends of injuries sustained by USAF members, many of which resulted in disability. Findings from this study will be integrated into the Biomechanics Branch's ongoing work to identify and mitigate injuries that lead to disability among Air Force members. This work is extremely important from a policy perspective, since the cost-share the Department of Defense pays for disabled service members each year is growing.

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## **CHAPTER 1.0      BACKGROUND**

### **1.1      Introduction**

Each year, thousands of AF members are discharged from the service because of disabling injuries. Disabilities due to musculoskeletal injuries represent the highest proportion of these discharges, many of which are preventable. Many service members retire with disability ratings and receive disability pay. Legislation enacted Jan. 1 2004 resulted in the Department of Defense (DoD) assuming a portion of the costs of disability payments that had been previously paid by the Veterans Administration (VA). Each year between now and 2014, this proportion will rise. It is estimated that the costs to DoD to date exceed \$1.8B. A more thorough understanding of disability trends and costs will assist policy makers in determining what research is necessary to further study disability prevention, fund this necessary research, and make policy decisions that minimize disability and its costs.

For quite some time, the military has viewed disability as being one-dimensional; the presence of a physical disorder or impairment. However, with the work of researchers and philosophers, the concept has progressed to a broader view, which implicates physical, mental, social health, and/or the work environment (Songer, 2000).

Disability is a major concern for administrators in military services, due to its affect on the availability of active duty and reserve personnel for combat and/or military missions. Physical disability that results in discharge from service results in increased use of medical care, and considerable compensation costs. For active duty military personnel, disability can be most immediately viewed from two perspectives—whether its impact is permanent or temporary. Permanent disability results in the discharge of the individual from active service. Temporary disability results in the loss of active duty status over a period of days, weeks, or years (Songer, 2000). Delayed recognition and response to health syndromes in the past have highlighted the critical need for real-time surveillance of the health status of forces as an enabling capability for decision makers (Reichard, 2004).

### **1.2      Research Objectives**

The objectives of this literature review were to examine the available statistics pertaining to disability within the United States Air Force (USAF); to identify prominent types of injuries faced by active duty personnel including their classification, which result in disability discharge; and to make recommendations for strategies that policymakers can use to combat this issue.

### **1.3      General Trends in Injuries and Compensation within DoD**

According to the statistics provided by Armoso and Canham (1999), titled Atlas of Injuries in the Armed Forces, military disability cases among active duty of the three military forces have shown about 90% increase from the mid 80's to mid 90's. Specifically for the Air Force, between 1990 and 1994, the disability cases increased 80% to 9/1,000 personnel/year. Although these statistics indicate that the “burden” of

disability among active duty Air Force members is not unique to the Air Force, the trends certainly call for immediate attention from the policy makers.

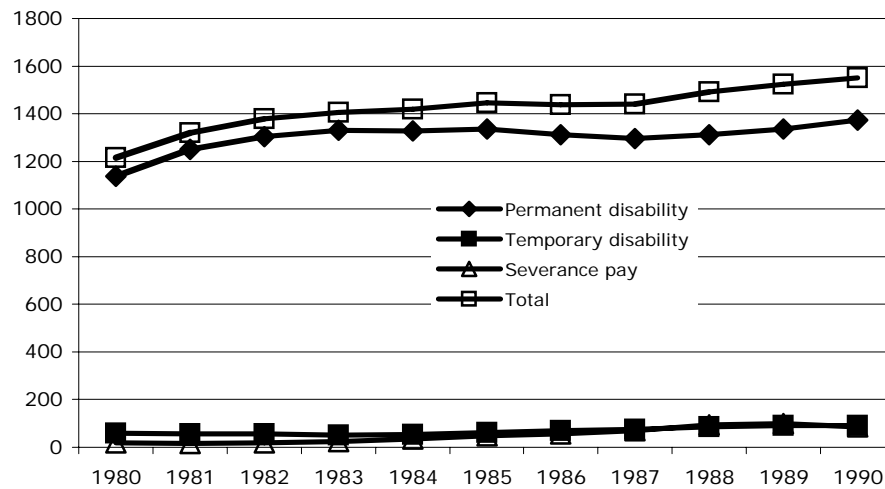


Figure 1. DoD - trends of combined disability compensation costs paid by the military departments (Army, Navy and Marine Corps, and Air Force), FY 1980-1990, by Armoso and Canham (1999).

Also, according to Armoso and Canham (1999), for the Air Force, the majority of disability cases evaluated were deemed fit for duty (41%). This is relatively low compared to other forces, which is shown in Table 1 (distribution of types of injuries) and Table 2 (disability disposition).

Table 1. Distribution of disabilities by two-digit VASRD codes for active duty personnel

Disabilities	Distribution (%) of disabilities (%)		
	Army FY 1994	Navy & Marine Corps FY 1995	Air Force FY 1994
Musculoskeletal	53	63	22
Mental disorders	14	10	21
Neurological/Convulsive	12	9	13
Systemic/Respiratory	7	6	14
Cardiovascular	3	4	6
Blood/Skin/Endocrine	3	3	12
Digestive	3	2	5
Visual/Auditory	2	2	2
Genitourinary/Gynecological	1	1	4

Table 2. Distribution of dispositions (case reviewed) for active duty personnel for FY 1994.

Disability disposition	Distribution of disposition (%)		
	Army	Navy & Marine Corps	Air Force
Separation with Severance Pay	43	61	19
Temporary disability	17	22	23
Permanent disability	15	4	15
Separation with No benefits	4	-	2
No rating	-	6	-
Physical fitness	-	2	-
Fit for duty	21	5	41

#### 1.4 Disability Defined

The first step in beginning research in this area was to define the term “disability” as it relates to the United States military; and to determine whether or not each branch had a unique interpretation of it. It was discovered that the federal government uses the description of the *American Disabilities Act* (ADA) to classify disability; and according to the ADA’s nondiscrimination standards, under section 501 of the Rehabilitation Act of 1973; the term disability is defined as:

- (1) A physical or mental impairment that substantially limits one or more of the major life activities of [an] individual;
- (2) A record of such an impairment; or
- (3) Being regarded as having such an impairment.

Further, a qualified individual with a disability is "an individual with a disability who satisfies the requisite skill, experience, and education and other job-related requirements of the employment position...and who, with or without reasonable accommodation, can perform the essential functions of the job (ADA, 2005)." The Atlas of Injuries in the U.S Armed Forces, categorized disability cases into five groups:

- Permanent disability – a permanent and stable disability resulting in discharge with full compensation for life.
- Separation with severance pay – disability resulting in discharge with a one-time separation payment.
- Separation without benefits – disability resulting in discharge, the disability existed prior to service and was not aggravated by service, or occurred as a result of intentional misconduct or neglect.
- Temporary disability – a medical disability that could improve (or worsen) over time, to be re-evaluated every 18 months; not fit for active duty.
- Fit for duty – return to active duty.

However, in order to be eligible for disability compensation by the federal government, disability is further defined by each organization’s benefits program: Social

Security Administration (SSA), and Veteran's Affairs (VA). A person is considered disabled under Social Security rules if he or she cannot do work that was performed prior to injury, and SSA decides that said person cannot adjust to other work because of his or her medical condition(s). The VA pays veterans disability compensation for disabilities that are a result of military service, as long as they meet the following conditions:

- You were injured while you were in the service, or
- You are permanently and totally disabled and you believe that it is because of your military service, or
- You were seriously ill while you were in the service, and you believe you have continuing problems, or
- You developed a mental or physical condition that you believe may be related to your military service.

For simplicity, the definition from each organization was combined in order to create a more detailed set of criteria to determine disability eligibility for the USAF (see Table 3).

Table 3. Types of disabilities compiled from OSHA, ADA, and Atlas of Injuries in the US Armed Forces.

<b>Type of Disability</b>	<b>Description</b>	<b>Scope of Injury</b>	<b>Cause</b>	<b>Compensation</b>
Permanent	Permanent and stable impairment resulting in discharge	Death, mental or physical	Loss of limb, mentally unfit diagnosis	Full compensation for life
Partial	Permanent loss, loss of use, or impairment of function	Physical extremity, vision or auditory	Vision/hearing loss	Full compensation
Temporary	A medical disability that could improve overtime-not fit for active duty	Physical or mental	Sprain, carpal tunnel	Partial compensation or full payment for specified time period
Separation	A member is unfit for duty who has less than 20 years of military service	Physical or mental	Member is assigned a disability rating of less than 30%	One-time separation payment

## CHAPTER 2.0 CLASSIFICATION OF DISABILITY TRENDS

The top five trends in disability classification and discharge for injuries among active duty Air Force members that have been identified by the literature reviewed herein, and grouped by classification: physical or musculoskeletal due to training-related injuries and death; psychological due to post-traumatic stress disorder, and social factors which include lifestyle, gender, genetic conditions, and even service classification. These injuries are further described below.

### 2.1 Physical Factors

#### 2.1.1 Death

It was discovered that death was also a very important factor to consider; and since there was uncertainty about how to classify this form of disability, it was grouped among the physical disability. “Deaths Due to Injury in the Military” (Powell, Kenneth, Lois & Fingerhut, 2000) discusses the types of injuries that cause the death of military personnel. Authors used data from the Department of Defense Directorate of Information, and examined the death rates of men and women in the services for unintentional injury, suicide, homicide, and illness from 1980-1992. During this time period, injuries accounted for 81% of all non-hostile deaths among active duty personnel in the Armed Services; the proportion of deaths caused by injuries in the Air Force was 78%. Unintentional injuries accounted for well over half the deaths in each service, ranging from 59% in the Air Force to 71% in the Marine Corps. In reviewing the specific causes of deaths in the services, motor vehicle crashes (private- and government-owned vehicle accidents combined) were the leading cause in all four branches. Bell, Amoroso, and Yore (2000) found supporting results from his research that revealed that heavy drinking, drinking and driving, speeding, low seat belt use, younger age, minority race/ethnicity, and enlisted rank were significantly associated with motor vehicle injury. Among active duty Air Force personnel, the prevalent causes were shown in Table 4.

Table 4. Prevalent causes of deaths among active Air Force members.

Cause	Number	% of total deaths
Suicide	67	29.5
Privately owned vehicle	53	23.3
Heart attack	27	11.9
Government owned vehicle	20	8.8
Total	275	

Another study provided an epidemiologic description of traumatic recruit deaths from 1977 through 2001 for the Air Force, Navy, Marine Corps, and Army. The purpose of the two population based study (Scoville, Gardner & Potter, 2004) was to determine the causes of nontraumatic sudden death among a cohort of military recruits. Authors used demographic and autopsy data from the Department of Defense Recruit Mortality Registry (DoD-RMR) for military recruits over the 25-year period. Based on their review,

authors found that most sudden deaths among apparently healthy young athletes occurred during exertion and were most often caused by cardiac abnormalities. Their investigation reported that 60% to 78% of exercise-related deaths in U.S. military personnel during 1996–1999 were attributable to a cardiac cause; and identified 19 sudden cardiac deaths from 1965 through 1985 during Air Force basic military training at Lackland Air Force Base, Texas, the only training site for Air Force basic military training. Deaths occurring during basic military training are of particular concern because they occur despite a pre-enlistment health screening program and have a substantial effect on the structure of basic training.

Scoville *et al.*'s (2004) study concluded that traumatic deaths appear to occur less frequently during basic military training (BMT); and showed that 16% of Air Force recruit deaths and 29% of a subset of Navy and Marine Corps recruit deaths were traumatic deaths. Furthermore, the majority (60%) of traumatic deaths were due to suicide, followed by unintentional injuries (35%), and homicide (5%). Based on the results, there were a lower proportion of traumatic deaths in recruits compared to the overall active duty military population and same-age U.S. civilian population.

## **2.2 Musculoskeletal**

In determining the existence and size of the problem, authors of “Injuries in the Military: A Review and Commentary Focused on Prevention” (Jones *et al.*, 2000), assert that accidental (unintentional) injuries remain the most significant health problem for all three branches of the military services. In reviewing the statistics provided in this article for each service branch, it appears that the USAF had the lowest death [disability] case evaluations and hospitalizations at that time. In the early 1990's, disability due to injury and disease, cost the military services approximately \$1.5 billion annually. The USAF disability case evaluation rate was the lowest among the branches, at about 10 per 1000 per year; 52 deaths per 1000 personnel per year; and 97 hospitalizations per 1000 per year (Jones *et al.*, 2000). The distribution of disability cases presented to the Air Force's physical examination board (PEB) in 1994 is represented in Figure 2.



### Distribution of cases presented to the PEB in 1994

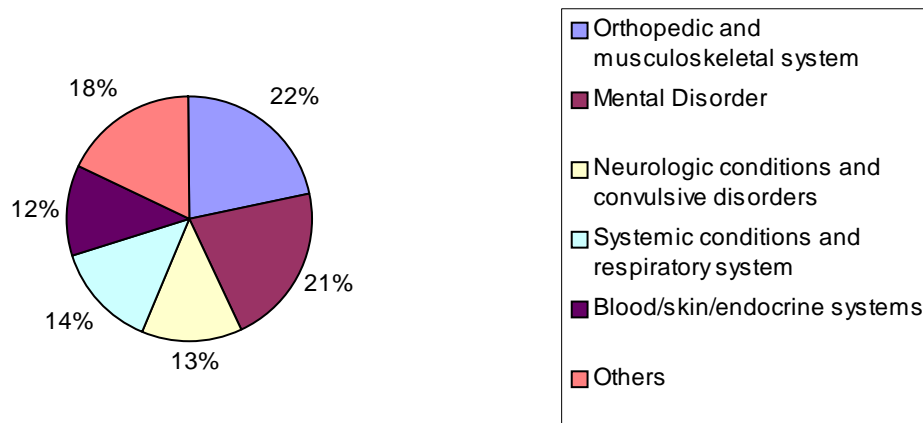


Figure 2. USAF medical conditions associated with disability in 1994. Adapted from “Injuries in the Military: A Review and Commentary Focused on Prevention.” In this, ‘others’ represents the combined percentage of infrequent conditions, which includes cardiovascular, digestive, gynecologic, and visual/auditory.

Although few studies have been done to examine the injury rates of recruits specifically for the USAF, research used in Snedecor, Boudreau, & Ellis’s (2000) study, which could be adapted to the USAF, indicated that training-related injuries were the number one cause of morbidity and limited duty due to medical restrictions in other service organizations. The purpose of this study was to assess the types, rates, and risks of injury for male and female USAF recruits. Outpatient visits for female (5250) and male recruits (8656) were collected and analyzed for rate of injury, types of injuries, and risk of injury throughout a 6-week training period. For the most part, research used in this study agreed that the less fit a person is, the greater the risk of injury during training. The most prevalent types of musculoskeletal injuries among male and female recruits were ankle and foot (747), knee (652), and upper body (540). Non-injury encounters included respiratory, psychological, and dermatological conditions. The results of the study showed that female recruits were at an increased risk for injury, compared to men, for all categories of injuries examined.

Popovich (2000) postulates that musculoskeletal injury is common in basic training, with reports of clinic visits for injury occurring in 15% to 31% of male recruits. His study was designed to prove whether or not the modification of running schedules in companies of Army recruits in basic training would prevent stress fractures among recruits. Stress fractures, described as an overuse injury, are a common occurrence in physical fitness programs; and have been associated with the rigors of marching, drilling, and running. Conversely, Armstrong’s (2004) study, which compared young men and women at the United States Naval Academy who sustained lower extremity stress fracture during a military summer training program with a matched group of uninjured recruits to identify factors that may increase the risk of a stress fracture, showed a slightly lower incidence for stress fracture among new recruits, which ranged from 2% to 12%.

Musculoskeletal injuries in basic training is said to contribute to substantial lost training time (Popovich, *et al.*, 2000).

Sports related injuries have also been implicated as a contributor to musculoskeletal injuries in the literature review. Soldiers who participate in sports, on both a recreational or competitive basis, and who's injuries occur as a result of participation in sports can lead to prolonged periods away from soldiers' primary duty requirements and can affect their deployment status. Since military readiness is a function of the ability of each person to perform his or her full duty, it may be an area of interest to decision makers (Lauder, Tamara, Baker, *et al.*, 2000). Other items to consider regarding injury risk factors during military training and/or sports participation include older age, female gender, greater amounts of running (Sherrard, 2004), low levels of physical activity/sedentary lifestyle, low levels of aerobic fitness/performance, previous injury history, and highly rigorous specialized training (Lenne, Stokes, and Ozanne-Smith, 2004).

### **2.3 Psychological Factors**

Little research has been uncovered thus far that describes the mental and neurological disabilities that affect military personnel. The authors of "Psychiatric Illness and the Workplace: Perspectives for Occupational Medicine in the Military," provided a review of the occupational medicine literature that examined the relationship between the work environment and employee mental health. This review suggests that a comprehensive examination of the relationship between the military work environment and the mental health of military employees is needed.

According to Pflanz (1999), it has been recognized that occupational problems are a frequently used diagnosis in military clinics, and this has been attributed to specific characteristics of the military environment. He estimates that each year, 15% of every work force will experience at least one episode of psychosocial disability and an additional 10% will suffer from problems related to alcoholism. Studies have found that stress claims represent up to 15% of all occupational disease claims and that stress-related occupational disease claims are increasing rapidly at the same time that all other disabling work injuries are decreasing. The number of stress claims increased 700% between 1979 and 1988, and the costs per stress claim average approximately \$12,000 per case, twice the average cost for all injury claims (Pflanz, 1999).

Implications for the military regarding this research are such that a significant percentage of military personnel suffer from psychiatric illness or emotional distress. This type of illness exacts a toll on military readiness through personnel absences from work, poor performance, poor morale, reduced unit cohesion, accidents, and injuries. Financial costs include medical (prescription and hospitalization), retraining costs, etc. Authors suggest that similar tactics used in the civilian sector could be used to minimize stress and mental illness among military personnel.

Snedecor *et al.* (2000) also showed that psychological factors, in addition to medical (relating to musculoskeletal) were the top two reasons for both male and female trainees

in terms of the number of disability related discharge in the military. The study did not address whether or not recruits who are discharged during basic training for medical and/or psychological reasons are eligible for disability compensation. Research published in the Military Medicine journal (Englert and Hunter, 2003) supported Snedecor et al's (2000) findings. This study examined the mental health related disorders that are prevalent with basic training and technical school students who are separated from the Air Force within the first year. The authors looked at the attrition rate of 1680 basic trainees and 338 technical school students who were sent to the Behavioral Analysis Service (BAS) from January 2001 to December 2001 (represented all racial and ethnic backgrounds and both genders). The major responsibility of this BAS is to provide screening service between those who were returned to duty and were expected to enter back into the training environment and those who were returned to their prior status but not recommended for a mental health discharge. The results showed that approximately one third of USAF enlisted fail to complete basic military training, and a large number of them are separated from active duty service due to mental health-related disorders; which results in a loss of approximately \$46,000 per individual in recruitment and training costs (Englert and Hunter, 2003).

Following a psychiatric evaluation, one of five recommendations (or disposition) is made to the trainee's command: return to training, hospitalization, return [visit] to BAS, medical hold, or administrative separation. As it relates to separation from active duty, the most common diagnosis for trainees was an adjustment disorder (234 basic trainees and 21 technical school students); the second most common cause of separation was due to a past or current diagnosis of a depressive disorder (71 basic trainees and 7 technical school students). Figure 3 illustrates this study's findings.

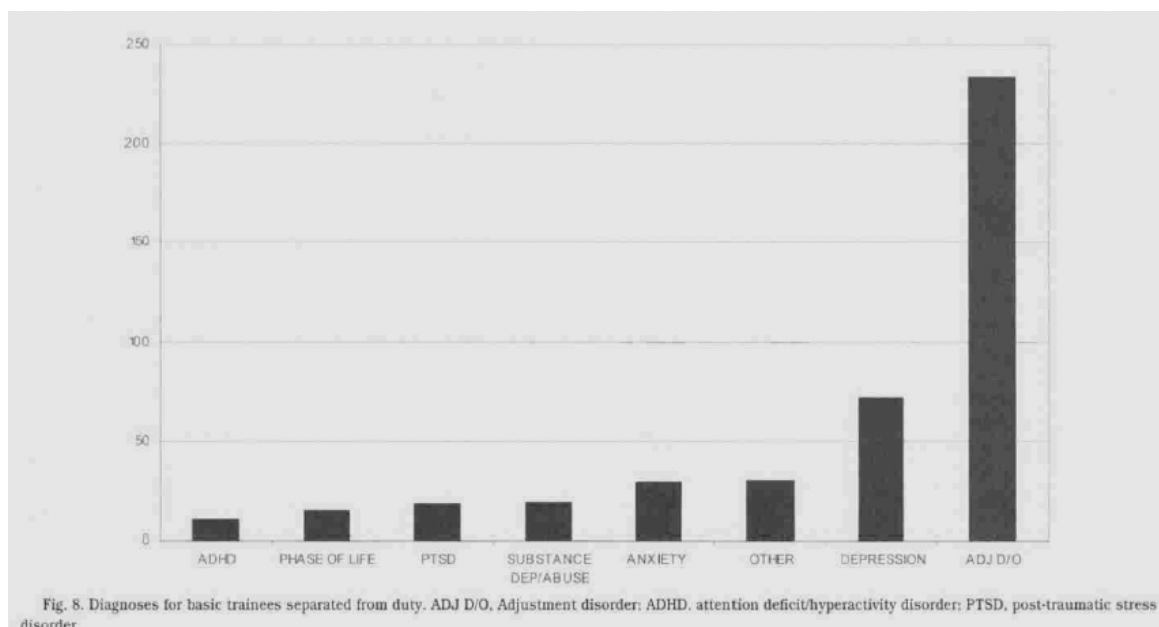


Figure 3. Diagnosis of depressive disorder for USAF basic military trainees. Taken from Englert, D., Hunter, C.L., USAF BSC, et al. (2003)

According to Staal, Fiedler and Cigrang (2000), a small but significant percentage of people entering the U.S. Air Force are evaluated during Basic Military Training (BMT) for mental-health-related issues. These trainees are referred for mental health evaluation for various reasons related to their adjustment to the training environment or past history of mental illness. Although the vast majority of trainees adapt to the stressors of the 6-week BMT course at Lackland Air Force Base, TX, a minority (approximately 5%) exhibit psychological reactions that lead to a formal mental health evaluation by a clinical psychologist.

The purpose of this study was to develop empirically derived profiles of the four disposition groups that distinguished trainees: (1) needing hospitalization due to emotional instability; (2) those requiring immediate separation from the Air Force but did not need hospitalization; (3) those who required administrative separation from the Air Force, but did not necessitate immediate care or removal; (4) and those who are returned to duty. The participants selected for their study were basic trainees (1,048) assessed at the BAS during a 6-month period. The data used for the analysis was collected from information routinely obtained during the standard evaluation process for basic trainees at the BAS: data from psychological testing (the Minnesota Multiphasic Personality Inventory), self-report questionnaires, and clinical interview notes. The findings of this investigation indicated that several key variables exist in the Air Force basic trainee's profile that may be used by the psychologists for disposition classification: diagnosis, suicidal intent (self-reporting plans to suicide), a history of physical or sexual abuse (or both), self-reported current impact of that abuse (physical, sexual, or both), past alcohol treatment. Results also showed that collectively, 70% of these trainees met the criteria for one of the following diagnoses: PTSD, depression, or adjustment disorder. In addition to diagnosis, a self-reported history of sexual abuse was also significantly predictive of the administrative separation group.

One study performed by Murdoch, Nelson, and Fortier (2003) examined the trends in the application and approval rates for Veterans Affairs who filed disability claims between 1980 and 1998 due to post-traumatic stress disorder (PTSD). Post-traumatic stress disorder is a term that describes psychological and emotional distress that develops following a stressful, traumatic event or series of events (i.e., war). The study was conducted on (180, 039) veterans who filed during this time period. Murdoch et al. (2003) claim that PTSD is now the most common psychiatric condition for which veterans seek service connection, and in 1998 the Veterans Benefits Administration paid about \$1.1 million each month in compensation to veterans with service-related PTSD (ADA, 2005). PTSD affects 7% to 12% of U.S. adults. In contrast, 30% of Vietnam combat veterans and 50% to 60% of former prisoners of war have been diagnosed as having PTSD. Among rape victims, the lifetime prevalence ranges from 30% to 65%. PTSD is the most common psychiatric condition for which veterans seek VA disability benefits (Murdoch, Polusny, Hodges and Cowper, 2006). Since 1980, more than 200,000 male and female veterans have sought VA disability benefits for PTSD, and each year the VA treats or compensates almost 600,000 veterans with this condition. The results of this study will be discussed in the next section.

Another study performed by Kozaric-Kovacic and Borovecki (2005) explored the prevalence of post-war psychotic symptoms among Croatian war veterans with combat-related PTSD. The study included 680 men who had experienced combat stress and had been diagnosed and confirmed with PTSD. According to the authors, an epidemiological survey indicated that approximately 80% of individuals with PTSD meet criteria for at least one psychiatric diagnosis. The most frequent diagnoses are major depressive disorder, other anxiety disorders, substance abuse, somatization, personality disorders, and dissociative disorders (Kozaric-Kovacic, 2005). The results of the study found that 15% of war veterans under expert examination for compensation-related purposes had current chronic PTSD, and 45% had PTSD with one or more comorbid diagnoses. These findings support that psychological factors are a serious contributing factor to disability among active duty USAF members, and provide strong evidence that this is an area that should be addressed by decision makers. They further suggest that more thorough methods of screening recruits prior to entry into the service be implemented.

Researchers believe that sexual assault is a widely recognized risk factor for PTSD. Although approximately one-half of women in the general population have been affected by sexual harassment at some point during their employment, almost 80% of a large representative sample of military women reported sexual harassment within a 1-year period. In most workplaces, including the military, coworkers perpetrate the majority of sexual harassment (Murdoch et al., 2006). A recent study performed by Murdoch et al. (2006), was conducted among female (and male) veterans seeking PTSD disability benefits to describe the association between post-traumatic stress disorder (PTSD) and in-service sexual harassment. The study was a cross-sectional survey; a 20-page, self-administered questionnaire to a representatively sampled, eligible pool of 2,466 men and 2,452 women who had previously filed VA PTSD disability claims. Surveys were mailed an average of 2 years after recipients had filed their claims, and almost all claims had been decided. The results of the 68% returned surveys indicated that the effect seen was about the same size as that seen for combat exposure among the men and for in-service sexual harassment among the women. Men actually showed no association between in-service sexual harassment and PTSD. On the contrary, reported in-service sexual harassment severity and current PTSD symptom severity had a small but statistically significant association. Their findings are consistent with earlier reports linking sexual harassment with PTSD among women.

Authors of “The Role of Sexual Assault on the Risk of PTSD among Gulf War Veterans,” argued that certain characteristics of the military setting such as high male to female ratios, traditional male environments, and predominance of male supervisors were factors that have increased the likelihood of sexually harassing behavior. Their research examined the role of sexual harassment and assault as predictors of PTSD symptoms among a population-based sample of US Gulf War female military personnel (15,000 Gulf War veterans and 15,000 non-Gulf veterans) obtained from the National Health Survey of Gulf War Era Veterans and Their Families. The results of the 76.3% survey respondents showed that nearly 24% of the females reported a history of sexual harassment, and 3.3% of the females reported a history of sexual assault. The study results suggest that given the same traumatic experience, whether combat related or

involving some form of sexual abuse, the risk for PTSD was highly significant for women [and men].

## **2.4 Social Factors**

Other research explored for this literature review has uncovered that lifestyle, gender, genetic conditions, and even service classification- although less common- can also contribute to instances of disabilities in active duty USAF officers, and have an effect on the decision-making process regarding policies in disability claims. According to “Review of Cardiac Events in USAF Aviators,” cardiovascular diseases have been, and still is, a significant cause of morbidity and mortality in the U.S. The study was conducted between 1988 and 1992, which included a population average of 33,058 pilots who were grouped by age. The results of the study identified 38 cardiac events among active duty USAF pilots, which averaged 7.6 events per year. The information obtained from this study suggests that age and cardiac risk factors are related; and could be used to select subsets of the USAF population who are at higher risk of experiencing heart disease for monitoring. Conversely, an article published by Pfizer Global Pharmaceuticals (1999), which described the prevalence of health issues within the United States Army between 1995 through 2000, stated that the diagnosed prevalence of total heart disease is low, 3%, but it increases with age. And, that heart disease is about five times more prevalent among older servicemen and servicewomen (9% and 10%, respectively), than among younger servicemen and servicewomen (2% each).

Another investigation into the social factors that contribute to disability claims was performed by way of a retrospective cohort study, which was conducted using self-reported health risk assessment data and cycle ergometry data (38,837) from active-duty Air Force (ADAF) members. The purpose of this study was to identify the independent effects of demographic and behavioral factors on risk of failure to meet USAF fitness standards. The results of the study proved that both demographic and behavioral factors play important roles in physical fitness. Furthermore, demographic groups at increased risk were toward the upper end of the ADAF age distribution, senior enlisted men, and African-Americans. Overweight/obesity was the behavioral factor with the largest effect among men, with aerobic exercise frequency ranked second (Robbins, Chao, Fonseca, Snedecor and Knapik, 2001).

Murdoch et al. (2003) research, which was discussed in the previous section, further suggested that a Veteran’s classification (whether or not he or she was documented as having a “service-connected” disability) determined if she would be eligible for VA medical services. Classification affected benefits to the extent that lack of service connection reduced the claimant’s odds of eligibility (ADA, 2005). The study found that rates of service connection for PTSD for combat-injured men and women were 89 and 92%; and for men and women without combat injuries, rates were 44% and 39%. Additionally, more claims were filed during and beyond the post-Vietnam eras. The United States Navy had the largest observed rate of claims, which averaged 93%; the USAF was second, with an 89% average.

In addition to service classification, gender was another factor that influenced the approval rates of Veterans. Murdoch et al. (2003) earlier research for this study, which was based on internal audits of PTSD claims, suggested that women Veteran's claim approval rates may be lower than men's. During this time period, 16.9 % of male, and 6.5 % of female USAF veterans filed for disability; and men's claim approval rates exceeded women's by 12%.

Bell's (2000) study investigated the association between gender and risk of exercise-related injuries among Army basic trainees given the same physical fitness activities and environment. 861 trainees were followed during the 8-week basic training courses. During the study it was determined that men entered into the program with significantly higher fitness levels than women on all measures except flexibility; and women experienced about twice as many injuries overall as men. Their risk for more serious time-loss injuries was even greater at almost 2.5 times the risk of the male trainees. Most injuries for both genders were to the lower extremity, or musculoskeletal. Authors believed that greater prevalence or severity of injuries may be due to the higher demands and constraints that women face, or because women are more affected by, or vulnerable to, the health impact of particular demands and constraints (Strazdins, 2004).

Other authors (Almedia et al., 1999) postulate that numerous factors have been considered, although not well studied, as possible etiologies for the increased injury rates reported in military women. These factors include women's poorer baseline fitness level, which was previously discussed; gender differences in musculoskeletal anatomy; characteristics of military training; and footwear. According to the authors, it has been well documented in both military and civilian populations that women use health care services at higher rates than men. The results of their study indicated that the higher injury rates often found in female military trainees may be explained by gender differences in symptom reporting.

Moreover, Sulsky et al. (2000) examined the separate and joint roles of gender, race/ethnicity, and age in the odds of discharge from the Army for disabling knee injury, among 860 women and 7868 men who were discharged from the Army between 1980 and 1995 for knee-related disability. The study found that Caucasian women were at higher risk for injury than Caucasian men at all ages except for the 23–27 year age group, non-Caucasian women were at lower risk than non-Caucasian men at all ages except for the 30–54 year age group, and that non-Caucasians were at lower risk than Caucasians at all ages and among both men and women.

Another study (Williams, & Amoroso, 2000) that examined the relationship between physical demands of military occupations and disabling knee injury among men and women in the U.S. Army, supported the claim that ethnicity due to physiological differences, has an impact on physically demanding tasks. For this study, a total of 7,454 individuals were sampled from the Total Army Injury and Health Outcomes Database (TAIHOD) system between 1980-1994, representing 1,005 cases and 3,009 controls among males and 860 cases and 2,580 controls among women; and the goal of the report is to group military occupational specialties (MOS's) into a classification system that

describes the physical demands of the job. The study showed that both non-caucasian women and men had reduced odds of discharge for knee-related disability compared to caucasian individuals.

## **2.5 Other Factors**

Aside from the injuries that active duty officers sustain during their time in the United States Air Force, research suggests that there are other ‘administrative’ factors that impact the rate of military disability claims. According to an article published in the Air Force Law Review, “a civilian Air Force employee may not be required to see an active duty Air Force doctor, or a civilian doctor employed by the Air Force as a civilian employee or contractor,” in order to obtain a diagnosis of mental disability, and be entitled to FMLA (Family Medical Leave Act) leave due to a psychiatric disorder (Turner, 2004). The issue here is that by the employee not providing information from a certified USAF physician, there is the risk of him or her being inaccurately diagnosed; thus creating an illegitimate disability claim. Thus, standardizing the protocol for active duty officers to be treated for injuries could potentially provide easier methods of tracking injuries.

Other research has found that since injuries are an undesirable occurrence in the military, unit leaders—like civilian managers—may have a disincentive to report them (Lincoln et al., 2000). It is imperative to address how the United States military, specifically the Air Force, sanctions this issue. Eckart et al. (2004) postulate that in order to avoid lost training days or disqualification from military service, recruits may not have disclosed symptoms of cardiac disease prior to their fatal and sudden death; which suggests that guidelines be set in place for physical examinations and screenings of new recruits.

Clark, Mahmoud, Krauss and Kelley (1999) agree that there is a clear benefit to setting policies and standards that are supported by the best available evidence and not by selected opinion or historical precedent alone. Authors have cited that the research of the Accession Medical Standards Analysis and Research Activity (AMSARA) has uncovered that there are more than 300,000 enlisted accessions per year. Furthermore, approximately 30 to 35% of all enlistees who entered the services separated before completion of the first term of service, and 10 to 15% were actually discharged in the first 6 months of duty. These rates were similar across the services. According to the AMSARA, there were more than 6000 medical discharges annually just for conditions that existed before enlistment. The Personnel and Readiness [division] estimated that the cost of recruiting, screening, and training an individual in the basics and initial skills was approximately \$20,000. Authors postulate that there is a clear benefit to setting policies and standards that are supported by the best available evidence and not by selected opinion or historical precedent alone.

Lincoln et al. (2000) also discussed several inconsistencies in how data is collected when injuries occur in the military, and cite this incongruity as one of the major reasons that information is not available for active duty officers. According to them, the 1.5 million members of the services, predominantly young adults, can be compared to



civilian populations in that they are subject to many of the same hazards that cause injuries [to civilians] in the course of work, travel, and recreation. The details of their study will be further discussed later on in this paper.

## CHAPTER 3.0      COMPENSATION

According to the report from Congressional Budget Office (CBO) before the subcommittee on personnel committee Armed Services United State Senate in 2003, in general, active-duty personnel retire from the uniformed services with either a disability or a non-disability retirement. If Department of Defense (DoD) determines that a service member is unable to perform his or her duties for medical reasons, it may offer that person a disability retirement. Payments under such a retirement are based on the member's highest three years of basic pay and on either the degree of disability or the number of years of service, whichever would result in a larger annuity. A disability retirement may be granted at any point in a person's military career. In 2002, 94,000 active-duty retirees who retired with a disability retirement received annuities totaling \$1.2 billion from the Military Retirement Trust Fund.

### 3.1      Disability Payment

Disability due to injury and disease cost the military services \$1.5 billion annually in the early 1990's. Between 1980 and 1998, PTSD was the most common psychiatric condition for which veterans sought service connection. In 1998 the Veterans Benefits Administration paid about \$1.1 million each month in compensation to veterans with service-related PTSD, which was approximately \$13,200,000 for that year.

According to Amoroso (1999), between 1990 and 1994, Air Force disability cases increased 80% to 9/1000 personnel/year. Jones (2000) asserts that the USAF disability case evaluation rate was the lowest, at about 10 per 1000 per year; 52 deaths per 1000 personnel per year; and 97 hospitalizations per 1000 per year. Between 1993 and 1994, the distributions of PEB disability claims for active duty Air Force personnel are illustrated in Table 5 and Figure 4.

Table 5. Distribution of PEB disability claims for active duty Air Force personnel.

1993 PEB disability claims (2, 940)	1994 PEB disability claims (3,687)
Temporary disability-36%	Temporary disability-23%
Fit for duty-28%	Fit for duty-41%
Separation with severance pay-25%	Separation with severance pay-19%
Permanent Disability-9%	Permanent Disability-15%
Separation with no benefits-2%	Separation with no benefits-2%

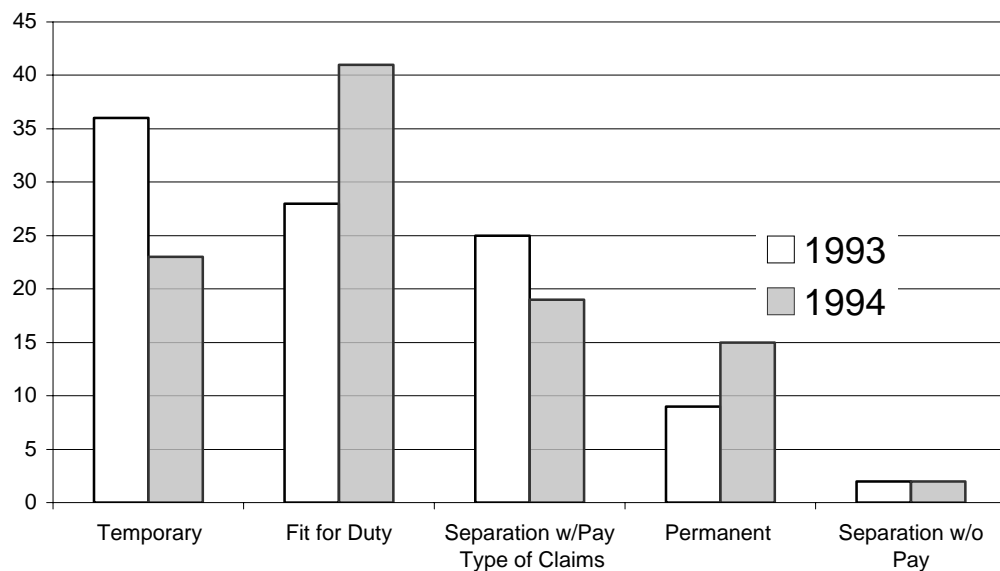


Figure 4. Distribution of PEB disability claims for active duty Air Force personnel - based on USAF Disability claims in 1993 and 1994.

Since no statistics were published for the USAF regarding actual cost of disabilities, estimates for Fiscal Year 1993 for the US Army (\$485 million total) were obtained from the aforementioned document, and used to estimate the cost of the USAF's disability cases, and are described below:

- Permanent disability-84% (\$407,400,000)
- Separation with severance pay-12% (\$58,200,000)
- Temporary disability-4% (\$19,400,000)

According to the DOD report on disability "Overview of Compensation Program for Service Members Unfit for Duty" (April 2001), approximately \$159 Million was spent in Disability Severance Pay, and \$1.27 Billion, was spent in Medical Retirement Pay for that year. The average retiree received \$13,060 for the year; the average officer retiree received \$24,260; and the average enlisted retiree received \$8,380 in medical payments which is in addition to other retirement pay.

Reville (2001) provided statistics for the workforce in the state of California, which did not directly analyze the military service. However, the types of injuries within the public sector could provide some insight into the significance of disability injuries within the military. In 1993, workers' compensation accounted for 2.1 percent of employee compensation nationally. In California, benefits paid to claims for permanent partial disability alone cost approximately \$5 billion per year. These statistics were not included in the trend line below.

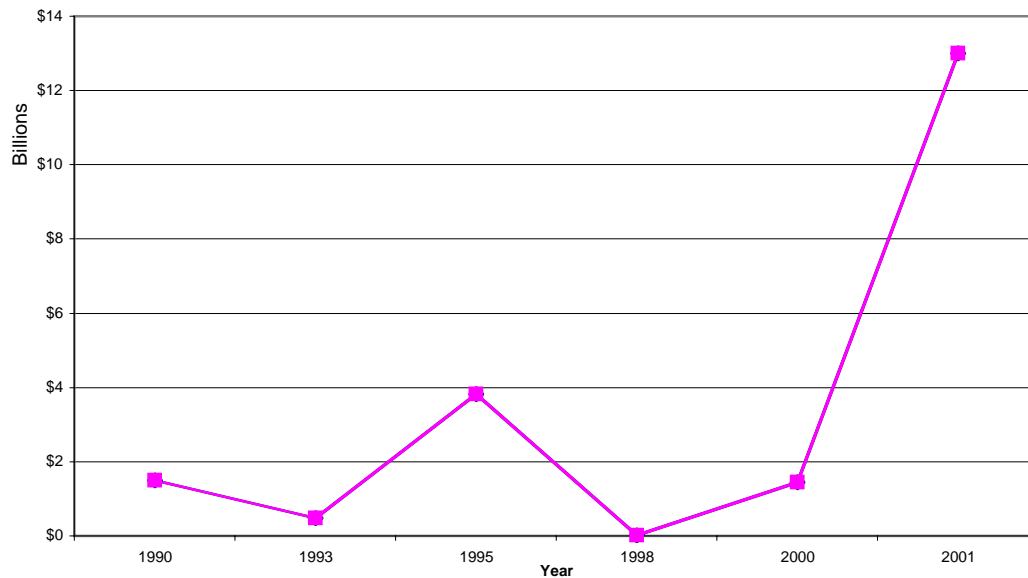


Figure 5. Estimate of the average USAF compensation from 1998-2001.

Figure 5 illustrates an estimate of the average disability compensation paid out to USAF members between 1998 and 2000. The dollar amounts were obtained from data provided by the literature review. Researchers agree that injuries are important in terms of loss of time from work and training and decreased military readiness. Statistics gathered from the literature review reveal that a substantial amount of money is lost to injured men and women during Basic training. In 1995, there were 153,228 recruit accessions due to knee-injuries for the combined services, each costing the Department of Defense (DoD) at least \$25,000 (Cox 2000). In 2001, approximately one third of USAF enlisted failed to complete basic military training, and a large number of them were separated from active duty service due to mental health-related disorders; which results in a loss of approximately \$46,000 per individual in recruitment and training costs (Englert 2003). During 12 weeks of basic training at Marine Corps Recruit Depot (MCRD), San Diego, injuries resulted in more than 53,000 lost training days and cost more than \$16.5 million per year (Kaufman, *et. al.*, 2000).

### 3.2 Disability Retirement

According to the Statistical Report on the Military Retirement System (2001), a disabled military member is eligible for disability retired pay if the member has at least 20 years of service, or the disability is at least 30 percent and either (1) the member has eight years of service; (2) the disability results from active duty; or (3) the disability occurred in the line of duty during a time of war or national emergency or certain other time periods. Members whose disabilities may not be permanent are placed on a temporary disability retired list and receive disability retirement pay just as if they were permanently disabled; however they must be physically examined every 18 months for any change in disability, and a final determination must be made within five years. According to this report, in 2001, 98,000 disability retirees were paid \$1.30 billion. The

DoD reported that from 1990-2001, for the United State Air Force, the number of *temporary disability claims* received for regular officers, non-regular officers, regular enlisted, and non-regular enlisted were 525 (total); 50; 46; 401; and 28 respectively. Dollars expended in 2001 for this type of disability were \$498,000 (total); \$101,000; \$72,000; \$300,000; and \$25,000. *Permanent disability claims* were 23, 529 (total); 3,506; 4, 543; 15,125; and 355. Expenditures were \$31,825,000 (total); \$11,046,000; \$8,174,000; \$12,362,000; and \$243, 000. *Temporary and permanent disabled* officers and enlisted claims were 24, 054 (total); 8,145 and 15,909. Expenditures for that year were \$32,323,000 (total); \$14,393,000; \$12,930,000. The number of military retirees receiving retired pay from the DoD for the USAF is listed in Table 6 and Figure 6.

Table 6. Number of Military retirees receiving pay from the DoD 1990-2001. Adapted from the Statistical Report on the Military Retirement System (2001)

<b>Year</b>	<b>Officer</b>	<b>Enlisted</b>
1990	157,384	381,239
1991	159,815	389,033
1992	162,517	397,371
1993	164,882	403,182
1994	166,532	406,957
1995	167,521	414,352
1996	167,866	419,070
1997	168,534	425,152
1998	169,056	431,313
1999	169,499	435,614
2000	169,401	438,753
2001	169,082	442,633

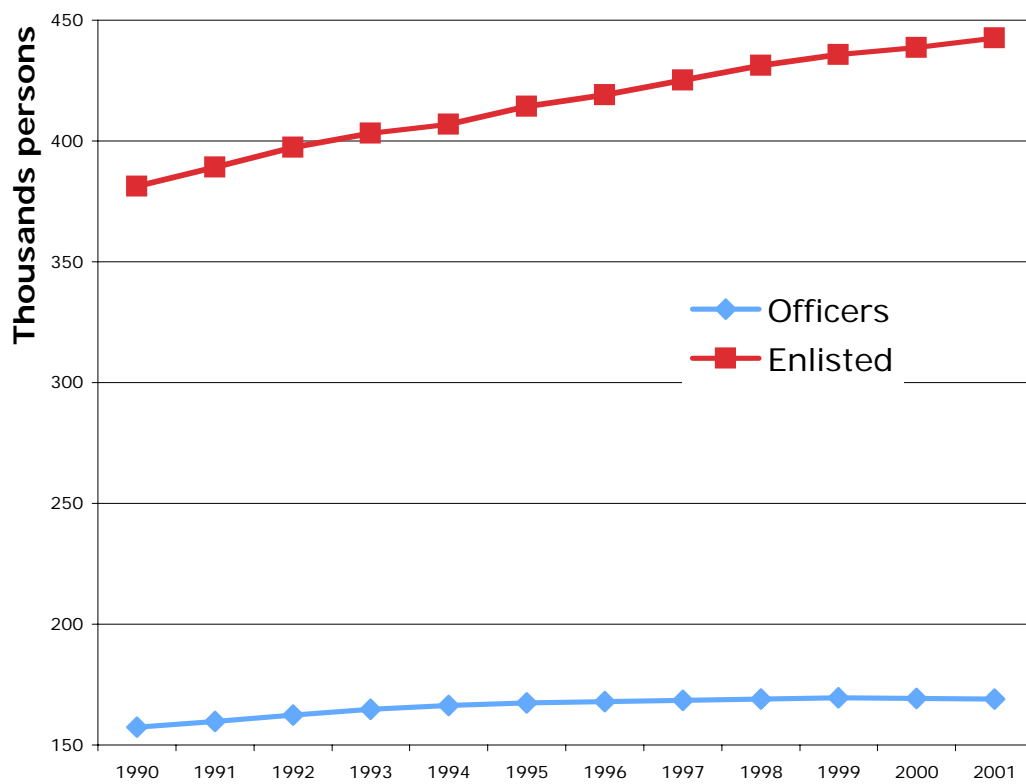


Figure 6. Graphical representation of military retirees receiving retired pay from the DoD 1990-2001.

## CHAPTER 4.0      RECOMMENDATIONS

### 4.1    ‘Disability Defined’ Revisited

Redefining disability to incorporate definitions from the Occupational Safety and health Administration (OSHA) and the Atlas of US Military Injuries is the first step toward addressing the number of disability claims filed by active duty USAF members, and could provide a more detailed description for evaluating compensation claims. Research shows that the definition is both broad and varies from one federal organization to the next. Uniformity in defining disability in the Air force, as well as all military branches could elevate some of the burden involved in determining disability eligibility.

### 4.2    Data Capturing

Tracking the medical data from various military health care facilities is one strategy that may work for how data is collected and examined regarding frequency and trends of disability among active duty officers. According to Lincoln et al. (2000), the “*Atlas of Injuries in the U.S. Armed Forces*,” compiled by the Department of Defense (DoD) Injury Surveillance and Prevention Work Group, was a first step in recognizing the importance of injuries to the Armed Forces, because it clearly identified the value of medical surveillance databases in the military. Other findings in their research showed that military surveillance data could provide useful information relating to injuries. For example, (military) hospitalization data was used to determine that women have a 3.9-fold greater risk of injury resulting in hospitalization than men, given the exposures associated with Army cadet basic training. This information is used to focus prevention efforts on high-risk groups (i.e., women); and to further demonstrate how injury patterns differ between the two genders. Similarly, when deaths occur in the military, as compared to civilian deaths, cause-of-death data coded on the death certificate is not available except those occurring in military hospitals. Authors believe that this is a major deficiency in otherwise good quality data available in the military (Lincoln, Andrew, Smith, Gordon, 2000); and further supports the claim that improvements in data capturing is imperative.

Reichard et al (2004) recommended that a tracking system be put in place to enable the USAF Surgeon General to collect medical data from various military health care facilities for the analysis and early detection of health issues-epidemics, and disease trends in specific cohorts of personnel in real time. The proposed system is called COHORT-Composite Occupational Health and Operational Risk Tracking system. The objectives of this system will be to monitor data in two categories- prospective and retrospective epidemiological data; in order to identify personnel who are at risk for experiencing a particular event as well as persons who have actually experienced the event. The system links military Integrated Clinical Databases (ICDB) around the world, into one centralized database (Reichard, 2004). And, as information is updated in the local systems, the COHORT system will update as well.

Information obtained from this system will allow authorities to strategize and respond in a timely manner to health issues among deployed men and women. From a research

standpoint, this system could prove to be a very effective method of compiling accurate and relevant data that is necessary for addressing the demands of military disability trends. Prior to his recommendations, several testimonies had been heard before the Subcommittee on National Security, Emerging Threats, and International Relations in 2003, on protecting the health of deployed forces, which support the implementation of the aforementioned surveillance system to generate data on deployed forces.

Regarding the design of the data tracking system, the type of coding used to describe injuries should be standardized throughout the branches of the military. At the very least, they should identify type of injury: physical, psychological, death; cause of injury; and details relating to the injury incident, such as location, time of day, etc. Lincoln et al. (2000) maintains that there should be separate 'trauma' codes so as to capture the full scope of injuries; and that the data set should include age, race/ethnicity, gender, diagnosis, cause, duty status, and circumstances of injury.

### **4.3 Physical Training Modifications**

#### **4.3.1 Quality Perspective**

From an Industrial Engineering standpoint, the United States Air Force can be viewed as a corporation whose objectives are to identify and reduce the number of injuries (or errors) that are occurring within its operations. With that said, there are a number of engineering tools, which are primarily used in the public sector that could be applied successfully within the USAF. A review of literature in this area found that one concept called Lean manufacturing has been linked to occupational ergonomics, which has extensive applicability for this research. The goal of Lean manufacturing is the effective utilization of resources to manufacture products at minimal costs. Thus, optimizing people and resources is critical to realizing this goal. At the same time, the main objective of occupational ergonomics is to design the work environment with the intent of supporting human performance (Egbert, 2000). Although both concepts are distinct- with different methods for measuring success- the means of achieving these goals are similar.

Within Lean manufacturing there are several areas of production where the idea of waste minimization has been addressed; and they include waiting time, transportation, processing and inventory, motion, and product defects. Ergonomic interventions directly affect reductions in these areas. As it relates to the military, processing time and worker motion are two very relevant concepts. Processing time refers to manufacturing tasks, which are [unnecessarily] carried out in order to meet production demands. Motion refers to excess movements required during production processing to retrieve necessary resources (i.e., tools and materials) and assemble components. Wasted motion increases the time spent on tasks, which in turn decreases the efficiency of production operations. Research studies have also demonstrated that psychological demands of tasks create ergonomic problems and quality deficiencies (Eklund, 1995).

In the military, processing time would relate to training activities, and [worker] motion would relate to the design and/or positioning of the training course and equipment. Key questions to ask that might prove to address these issues are which tasks



are physically and psychologically most demanding; whether aspects of the rigorous training program can be shortened and/or eliminated, yet still provide the desired results in recruits; and can modifications be made to the training course and or equipment worn by recruits? According to Egbert (2000), as movement lengths increase, operators take their joints to full range of motion. These types of postures that stretch the musculoskeletal system to its limit increase ergonomic risk. Through modifications of job tasks by way of anthropometry, extreme postures can be minimized to improve task efficiency, and provide a safe work environment.

#### **4.3.2 Investigative Perspective**

Many of the studies examined herein agree that over training military personnel provides high risk of injury. In as much, a research study conducted by Schneider, Bigelow, and Amoroso (2000) found that individuals whose immediately preceding injury was traumatic (as opposed to an overuse or unspecified pain injury) had an 83% increased likelihood of subsequent injury. This increased risk may be a result of inadequate recovery time after the initial traumatic injury. Furthermore, it suggests that changes in the medical management of these individuals should be considered.

Sherrard et al. (2004) and Kaufman (2000) found that the most promising method of improving physical fitness levels while minimizing injury risk to military recruits may be to modify basic training programs. The authors conducted searches of computerized databases of published literature regarding disability and exercise as it relates to the military, in order to assess the injury prevention measures that were recommended. Authors found that the major injury risk factors during military training include older age, female gender, greater amounts of running, low levels of physical activity or sedentary lifestyle, low levels of aerobic fitness/performance, previous injury history, and highly rigorous specialized training. “The most effective way to improve the level of physical fitness may be to alter the training regimen by increasing the duration, frequency, and intensity of the initial training events gradually. This approach accommodates the incoming, poorly fit recruits without compromising the fitness of the graduating recruits (Kaufman, Kenton R., Brodine, Stephanie, Shaffer, Richard, 2000).” In their research, the authors further described a successful training intervention for Marine recruits:

To reduce injuries and maintain fitness of Marine recruits, the San Diego MCRD conducted a training intervention trial. The intervention included reduction in the amount of running miles, gradual build-up of exercise and military hiking, and emphasis on aerobic activities in early training phases before progressing to anaerobic activities and strength conditioning. Evaluation of this intervention demonstrated a significant reduction in all overuse type injuries. Lower extremity stress fractures were reduced by 55%, which resulted in 370 fewer stress fractures per year with a cost savings of over \$4.5 million at the San Diego MCRD.

Moreover, optimal training should be identified for individuals of different fitness and performance levels so that the high injury risk due to over training can be avoided while maintaining the required level of physical fitness. Kuruganti et al. (2004) feel that appropriate task analysis is key to the development of suitable occupational fitness tests.

This human factors technique (a measurement-based methodology) could be very useful in analyzing the resources required for successful work performance and redesigning military fitness programs. After the early years of military training, the work environment and lifestyles of many Air Force and military personnel tend to reflect that of the general population (Lenne, M., Stokes, M. and Ozanne-Smith, 2004). Thus, the demonstrated health benefits of monitoring and modifying physical training programs so as to decrease the number of disability claims in the military can have a positive effect if applied to the (general) public sector.

## CHAPTER 5.0 SPECIAL OPERATIONS

### 5.1 Description

The Air Force Special Operations Command (AFSOC) consists of pararescuemen (PJ) and combat controllers (CCT). This elite force of service men and women, known as “the quiet professionals,” provide units and expertise to US Special Operations Command and to theater combatant commanders. The AFSOC contributes to joint operations in five mission areas: precision employment/strike, information operations, special operations mobility, shaping the battlespace, and agile combat support (Kamps, 2005). These mission areas involve unconventional warfare, special reconnaissance, foreign internal defense and counter-terrorism support to unified commands. Specifically, special tactics teams deploy Air Force combat controllers and pararescue personnel to select assault zones, provide terminal guidance and control for fire support, manage air traffic control, and conduct combat medical care and personnel evacuation. Their mission is to



Figure 7. Applicants in a 306<sup>th</sup> Rescue Squadron pararescue screening do sit-ups in a mud pit while holding a log at Davis-Monthan Air Force Base in Arizona (photo credit: USA Today, 5/24/2006).

provide the air component of U.S. Special Operations Command, and deploy specialized airpower and deliver special operations combat power.

### 5.2 Numbers

In 2002 it was reported that there were 8,834 active duty members of AFSOC (1,407 Officers and 7,427 Enlisted) with less than 500 of them assigned to this specialty (Seydel, 2003). According to Vanden Brook's (2006) report, all military special operations forces have been expanding since then by adding 6,000 people and almost doubled its budget, according to the Pentagon. There are about 17,000 special operations troops in the Army, Navy, Air Force and Marines. Women are not allowed to compete for positions within the AFSOC because the job involves the potential for ground combat (Poindexter, 2004 and Glenn, 2000). In order to be fully staffed in 2002, the Air Force needed 426 combat controllers-it had 350. A full complement of pararescuers was 123- there were 90. Interestingly, in order to fill the void of specialists, the Air Force has been expanding their recruiting efforts to include motocross racing and other “thrill seeking events.”

### 5.3 Training

Training for special operations begins with the Indoctrination Course, which is a 12-week physical and mental training program. From there, a 4-week Army combat diver course, 3-week parachute training, 8-weeks of free-fall parachute training, and 2.5-weeks of survival training (Poindexter, 1994). It has been said that physical, mental and emotional toughness are essential. At the same time, the nature of their jobs demands that Air Force special tactics airmen become skilled swimmers and comfortable underwater. The Air Force is looking for “the type-A personality, unusually aggressive, and focused.” According to Vanden Brook’s (2006) report, two-thirds of applicants to the Air Force special operations forces wash out, which means that only one in three will actually complete the training.

#### 5.3.1 Combat controllers

The role of a CCT is to set up air traffic control and perform close air support in remote locations. After the Indoctrination training, combat controllers go on to a 24 month specialized training which includes a 10-week communications course. Trainees move from basic to advanced special operations skills during this time frame, which include Army airborne, survival, combat control, air traffic control schools, and advanced skills training (Seydel, 2003). During each phase of the training, threatening exercises (like “flutter-kicks” and “buddy-breathing,” which occur during pre-scuba) test endurance, confidence and discipline, in recruits (on the left: Air Force Combat Controllers make a call to aircraft using their radios after having penetrated a Florida shoreline with tactical underwater breathing equipment during a training event).



Figure 8. Combat controller 1C2X1 (photo credit: USAF fact sheet).

### 5.3.2 Pararescuemen

Pararescuemen (PJ's) are registered emergency medical technicians trained to find and treat downed pilots or other patients (Glenn, 2000). PJ's training begins with a 2-week



pararescue preparatory course that teaches trainees the required skills to succeed in the indoctrination course. After the Indoctrination training, pararescuemen undergo a 43-week course where they are trained for specialized techniques and qualified as a paramedic (EMT). Training involves Army Airborne school, combat divers school, underwater egress training, basic survival, free fall parachutist school, paramedic course, and a pararescue recovery specialist course ([www.af.mil/factsheets/factsheet](http://www.af.mil/factsheets/factsheet))

Figure 9. You might as well JUMP! - OVER LACKLAND AIR FORCE BASE, Texas - Airmen from the 346th and 342nd Training Squadrons perform a high-altitude, low-opening parachute jump onto the base's parade grounds below Feb. 21. The proficiency training exercise had combat controllers and pararescuemen exiting the aircraft at 9,500 feet, traveling at 130 knots, and landing on a precise target at the drop zone. (U.S. Air Force photo by Master Sgt. Lance S. Cheung)

At the very least, trainees should be able to run 3 miles at a seven-minute-a-mile pace, swim 1,000 meters non-stop and do about a dozen pull-ups and 75 sit-ups. Swimming may be the most physically demanding task, and about one in four who drop out are culled during that portion of the training. Even more — 30% — are lost in the combat controller's apprentice course, which includes land navigation and small-unit tactics (Vanden Brook, 2006). For pararescuemen, approximately 75 graduates are needed annually to meet the Air Force's goals. However, only about 45 students get through the course (Rolfen, 2004).

According to Potter (2002), after completing basic and advanced training, soldiers continue physical conditioning and advanced readiness programs with high risk of injury. The majority of the physical activities required of Special Forces candidates to perform during training involves running. The intense amount of running can lead to over stress injuries of the lower extremities in trainees who arrive not physically prepared to handle the activities (McCormack, 2006).

### 5.4 Injuries

A search of the medical literature and government documents did not reveal numerous published sources regarding the extent of injuries among military Special Forces. According to one author (Potter, 2002), injury rates and specific types of injuries are not as well characterized for operational military training units, such as the special operators, as they are for basic training. In fact most military studies have focused on

basic training injuries. His research revealed that musculoskeletal injuries in Army infantry soldiers have been reported to range from 80 to 150 injuries per 100 soldier-years, whereas in US Naval SEAL training there were up to 360 injuries per 100 soldier-years. Kaufman et al. (2000) provided supporting statistics that described injuries among 449 Naval Special Warfare trainees being primarily caused by stress fractures. Although this research is not specific to the United States Air Force, it can be generalized to characterize injury causes for special operations forces.

Between 2001 and 2002, the AFSOC experienced a spike in aircraft accidents, which prompted them to provide pilot with additional training and triggered interest in upgrades to the organizations fixed-wing aircraft and helicopters (Wall, 2002). Accident rates increased to above 13.3 Class A accidents per 100,000 flight hours during a 12-month period. According to Wall (2002), the AFSOC has made some improvements to the aircraft by improving pilots' situational awareness during landing; made some training adjustments to better prepare pilot for extreme environments. The one improvement that was mentioned in the article regarding better restraining devices for troops traveling in the back of the aircraft was pending.

In a one-year study conducted among 1,965 members of the 82nd Airborne Division to quantify musculoskeletal injuries, researchers found that the sample cohort experienced 508 overuse injuries, including 38 stress fractures/reactions. Stress fractures accounted for 7.5% of all over use injuries. At the same time, 1,415 traumatic injuries occurred, of which 100 were fractures (7.1%). Injuries resulted in 22,041 limited duty days, averaging 11 days per injury and 13 days per soldier. Fracture and stress fractures produced the most days lost per case. In examining specified injury causes, parachute jumping was the leading cause of injury in the study population for both genders. Figure provides an illustration of causes of injury for both genders. Several other causes were directly related to marching, running/jogging. Thus, activities with the highest injury rates resulted from formal military-related activities.

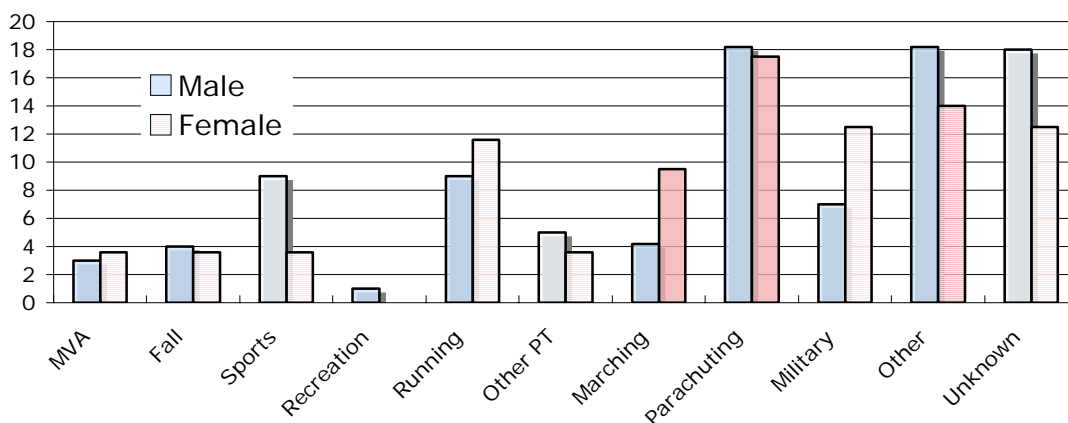


Figure 10. Injury rates per 1,000 soldier-month by gender and self-reported cause. Taken from Potter (2002).

Another study conducted a health assessment (survey) of the US Army Rangers to collect information to be used by healthcare professionals for making recommendations about future desirable behaviors (Deuster, 2003). The authors' interest in this population was because Rangers routinely undergo rigorous physical training and experience high levels of stress, their nutrition and health behaviors would be important for formulating recommendations regarding short and long term health objectives.

The data collected from this study indicated that a diet high in fat (38% of energy), and low in carbohydrates (41.9%) and protein in take (17.9% of energy), was consistent with recommendations for endurance and strength training athletes. Conversely, 76% of the volunteers reported using alcohol on a regular basis, and 52.6% used some form of tobacco. The use of supplements was high with 13% taking creatine and ephedrine products on a regular basis. Thus, these negative lifestyle behaviors could have a detrimental effect on performance. The results of Deuster's (2003) study suggested that, given the high level of physical activity coupled with dietary and health behaviors, health education programs may be important in this select Army population. This coincides with recommendations made earlier in this report regarding the non-specialized servicemen and women.

An interesting finding was uncovered in the literature review regarding the use of medical waivers among the AFSOC. According to Storms, Michaelson, and Brehm (2003), illness or injury may disqualify members from continued service, based on published medical standards. In these circumstances, it is common to seek waiver consideration. A waiver is a provision to extend the qualification standards on a case-by-case basis, and is only possible if it can be demonstrated that the affliction does not represent a danger to the health of the individual in the military environment, and if the mission can be safely and effectively accomplished in spite of the identified medical problem.

The authors conducted a study that examined the waiver experience at Air Force Special Operations Command (AFSOC) from 1992 through 2003. Within the study population, 170 were combat controllers, which accounted for 16.3% of the population-the largest of the occupational sample; there were 51 pararescuers, which accounted for 4.9% of the population. Table 7 below describes the occupational breakdown of the study population.



Table 7. Occupational breakdown of study population. Taken from Storms, P., Michaelson, R., and Brehm, W. (2004).

Occupation	Number	% of Total
Combat controller	170	16.3
Pilot	160	15.4
Navigator	134	12.9
Loadmaster	112	10.7
Flight engineer	102	9.8
Aerial gunner	89	8.5
Pararescue	51	4.9
Sensor operator	31	3.0
Electronic weapons officer	26	2.5
Parachutist	24	2.3
Radio operator	22	2.1
Linguist	21	2.0
Flight surgeon	14	1.3
Air traffic control	12	1.2
Gunner	11	1.1
Combat weather*	11	1.1

\*Occupations with fewer than 10 members represented: Airborne communications 8, Jump Duty 8, Fire Control Officer 5, Flight Steward 5, Flight Test Engineer 4, Tactical Air Vehicle Operator 4, Medical Technician 4, Unknown 2, Airborne Radar 1, Weapons Systems Operator 1, Weapons Controller 1, Mission Crew Commander 1, Tactical Air Control 1, Physiologist 1, Security Police 1.

The results of the study showed that there were 1042 individuals considered for waivers of the 1270 medical conditions. Combat controllers were statistically more likely to seek waiver consideration than would be expected in the general AFSOC population. The five most commonly encountered medical diagnosis among the groups were: otorhinolaryngologic, 26.9%; musculoskeletal, 17.6%; ophthalmologic, 10.9%; cardiovascular, 7.2%; and gastrointestinal, 7.9%. It was discovered that waivers were granted to 83.9% of the group. Pilots and navigators were more likely to receive a waiver, and aerial gunners were less likely to receive a waiver.

## 5.5 Implications

The research literature regarding the AFSOC suggests that the majority of injuries to servicemen occur primarily during training. The primary types of injuries include stress fractures and overuse injuries (musculoskeletal), which agrees with research uncovered for the unspecialized United States Air force population. A startling finding was discovered regarding the over use of medical waivers within the AFSOC's largest command, the combat controllers-particularly for chronic medical conditions. This point could have serious implications toward the number of injuries sustained among active duty servicemen; and could yield important operational risk management insight (Storms et al. (2003). The research further suggests the need for health educational programs for this population.



## APPENDIX A

## A.1 References - Disability

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<sup>1</sup> \* denotes an article that was not summarized

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## APPENDIX B Annotated Summaries of Articles Reviewed

**[1] Title: Psychiatric Disabilities In The Federal Workplace: Employment Law Considerations.**

**Authors:** Turner, Miranda W.

**Source:** Air Force Law Review; 2004, Vol. 55:313-335

**Summary/Abstract:** This article discusses the issues employment lawyers may encounter dealing with mental illness in the work place. Specifically, this article examines the Rehabilitation Act as it applies to psychiatric disabilities or disorders. The point of interest in this particular document is on page 327, where it explains that a “civilian Air Force employee may not be required to see an active duty Air Force doctor, or a civilian doctor employed by the Air Force as a civilian employee or contractor,” in order to obtain a diagnosis of mental disability. By the employee not providing information from a certified USAF physician, there is the risk of employees being inaccurately diagnosed, thus creating an illegitimate disability claim. Page 314 also provides some federal government statistics of claims.

**[2] Title: Disabilities due to injury in the military.**

**Author:** Songer, TJ; LaPorte, RE

**Source:** American journal of preventive medicine, 2000 Apr, 18(3 Suppl):33-40

**Summary/Abstract:** The role of injuries in physical *disability*, from the early 1980s to 1994 was assessed by reviewing administrative data from the U.S. Army, Naval, and the Air Force Physical Disability Agencies respectively. The authors examined information on the number of *disability* cases reviewed in 1994, the leading causes of *disability*, and the disposition of each case. Also, information from the Department of Defense on the cost of compensating *disability* cases was reviewed. The data used for this report showed that the rate of disability cases reviewed for the Air Force increased by 49% between 1990 and 1995. The disposition of cases presented to the PEB in 1994, showed that only 23% of cases were for temporary disability claims; and the majority of cases, 41%, were fit for duty. Their research further described the leading causes of disability, as coded by the Air Force PEB. Orthopedic and musculoskeletal conditions were the leading factors for disability cases in all of the services in that same year.

**[3] Title: U.S. Air force recruit injury and health study.**

**Author:** Snedecor, MR; Boudreau, CF; Ellis, BE;

**Source:** American journal of preventive medicine, 2000 Apr, 18(3 Suppl):129-40

**Summary/Abstract:** To assess the types, rates, and risks of injury for male and female USAF recruits. Outpatient visits for female (5250) and male recruits (8656) were collected and analyzed for rate of injury, types of injuries, and risk of injury throughout a 6-week training period. The study was performed on “brother-sister” flight pair groups: male and female recruits that started training at the same time and within the same squadron. Information from personnel information systems and daily squadron reports were used to support the study, which provided the status of all recruits involved.

[4] ***Mishap Statistics Scoreboard***. **Combat Edge**, Mar2005, Vol. 13 Issue 10, p31, 1p;  
**Summary/Abstract:** Provides statistics on the types of injuries that occurred to enlisted service personnel, groups the injuries by type-aircraft, ground, weapons; and classification-permanent disability, permanent partial disability, and lost workday. The scoreboard provides statistics dating from December 2001-March 2005.

[5] **Title: COHORT: An Integrated Information Approach to Decision Support for Military Subpopulation Health Care**

**Authors:** Lt Col G. D. "Rick" Reichard-Chief, Health Modeling & Informatics Division: Air Force Medical Operations Agency

**Source:** Presented at the International Command and Control Research Symposium 2004. (ICCRS)

**Summary/Abstract:** The purpose of the COHORT-Composite Occupational Health & Operational Risk Tracking- system is to enable the USAF Surgeon General to collect medical data from various military health care facilities for the analysis and early detection of health issues-epidemics, disease trends in specific cohorts of personnel, in real time. The objectives of this system will be to monitor data in two categories-prospective and retrospective epidemiological data. The system links military Integrated Clinical Databases (ICDB) around the world, into one centralized database. And as information is updated in the local systems, the COHORT system will update as well. Information obtained from this system will allow authorities to strategize and respond in a timely manner to health issues among deployed men and women. The paper further describes the technology that will be used in the design of the COHORT system.

[6] **Title: Time, gender, and regional trends in the application for service-related post-traumatic stress disorder disability benefits, 1980-1998**

**Authors:** Maureen Murdoch, David B Nelson, Larry Fortier.

**Source:** Military Medicine. Bethesda: Aug 2003. Vol. 168, Iss. 8; p. 662

**Summary/Abstract:** The aim of this study was to assess time, gender, and regional trends in the application and approval rates for Veterans Affairs who filed disability claims between 1980 and 1998 due to post-traumatic stress disorder (PTSD); and to describe gender and regional variations in VA claim approval rates for this type of claim. [6] The study was conducted on 180, 039 veterans who filed during this time period. According to the author, PTSD is now the most common psychiatric condition for which veterans seek service connection, and in 1998 the Veterans Benefits Administration paid about \$1.1 million each month in compensation to veterans with service-related PTSD.

[6]

[7] **Title: Americans with Disabilities Act (ADA).Disability Discrimination:**  
**<http://www.eeoc.gov/types/ada.html>**

[8] **Title: Review of Cardiac Events in USAF Aviators**

**Authors:** Sandra Osswald, Ralph Miles

**Source:** Aviation, Space, and Environmental Medicine. November 1996. Vol. 67(11); p.1023-1027

**Summary/Abstract:** The purpose of this study was to define the cardiac event rate-although rare-in USAF aviator population, and to examine the circumstances surrounding these events. Researchers investigated several USAF organizations-the Surgeon General's Office, Personnel Center, etc.-to obtain information regarding active duty pilots and navigators who experienced a cardiac event, which included myocardial infarctions, angina, and sudden death. The study was conducted between 1988 and 1992, which included a population average of 33,058 pilots who were grouped by age.

**[9] Title: Injuries in the Military: A Review and Commentary Focused on Prevention**

**Authors:** Bruce Jones, Dennis M. Perrota

**Source:** American journal of preventive medicine, 2000 Apr, 18(3 Suppl): 71-80

**Summary/Abstract:** This article reviews the types and categories of military morbidity and mortality data examined by the Armed Forces Epidemiological Board (AFEB) work group and the companion Department of Defense (DoD) Injury Surveillance and Prevention Work Group. In 1996, this group issued a report that cited injuries as the leading cause of morbidity and mortality among military service members. They too recognized a need for systematically reducing injuries and other health related issues among service men and women. As a strategy to address these issues, the group chose a five-step public health approach, which was adapted from other researchers, as a framework for the evaluation of military medical information. The work group also considered a number of interventions that could alleviate the injuries that individuals were experiencing.

**[10] Title: Deaths Due to Injury in the Military**

**Authors:** Powell, Kenneth, Lois Fingerhut, *et al.*

**Source:** American journal of preventive medicine, 2000, 18(3 Suppl): 26-32

**Summary/Abstract:** This article discusses the types of injuries that cause the death of military personnel. The researchers used data from the Department of Defense Directorate of Information, and examined the death rates of men and women in the services for unintentional injury, suicide, homicide, and illness from 1980-1992. From 1980 to 1992, injuries (unintentional injuries, suicides, and homicides combined) accounted for 81% of all non-hostile deaths among active duty personnel in the Armed Services, and illness accounted for 19%. The proportion of deaths caused by injuries in the Air Force was 78%. Unintentional injuries accounted for well over half the deaths in each service, ranging from 59% in the Air Force to 71% in the Marine Corps. However, unintentional injury death and homicide rates were lowest for the Air Force. The rate of unintentional injury death ranged from 43.0 per 100,000 person-years in the Air Force, and the homicide rate ranged from 2.6 to 7.4. In reviewing the specific causes of deaths in the services, motor vehicle crashes (private- and government-owned vehicle accidents combined) were the leading cause in all four branches. Among active duty Air Force personnel, the prevalent causes were:

Table B-1. The prevalent causes of deaths in Air Force.

Cause	Number	% of total deaths
Suicide	67	29.5
Privately owned vehicle-auto	53	23.3
Heart attack	27	11.9
Government owned vehicle-aircraft	20	8.8
Total	275	100.0

A question that this topic summons is how the military classifies death injuries-permanent or separation-for disability compensation purposes.

**[11] Title: Prior Knee Injury and Risk of Future Hospitalization and Discharge from Military Service**

**Authors:** Cox, Karin, Kathryn Clark

**Source:** American journal of preventive medicine, 2000, 18(3 Suppl): 112-117

**Summary/Abstract:** This article provides supporting information for the literature review regarding musculoskeletal injuries and their impact on active duty discharge cases. The loss of new recruits during initial training and first military assignment is costly in terms of dollars and military readiness. In 1995, there were 153,228 recruit accessions for the combined services, each costing the Department of Defense (DoD) at least \$25,000.

The authors conducted a retrospective follow-up study on individuals entering active duty between January 1995 and December 1996 as verified through accession data from the Defense Manpower Data Center (DMDC). The analysis from the study suggested that Army men with knee waivers are less likely to be retained on active duty. There was a significantly reduced rate of retention (survival) for Army high-risk women and the respective comparison group.

**[12] Title: High Injury Rates Among Female Army Trainees: A Function of Gender?**

**Authors:** Bell, Nicole, Thomas Mangione

**Source:** American journal of preventive medicine, 2000, 18(3 Suppl): 141-146

**Summary/Abstract:** The purpose of this study was to investigate the association between gender and risk of exercise-related injuries among Army basic trainees given the same physical fitness activities and environment. 861 trainees were followed during the 8-week basic training courses. According to the authors, a few studies have suggested that female trainees were less physically fit than their male counterparts on entry into the program. Low levels of physical fitness are measured by sit-ups, run times, and body decomposition.

**[13] Title: Effect of Rest from Running on Overuse Injuries in Army Basic Training**

**Authors:** Popovich, Rose, John Gardner

**Source:** American journal of preventive medicine, 2000, 18(3 Suppl): 147-155

**Summary/Abstract:** This study was designed to prove whether or not modification of running schedules in companies of Army recruits in basic training would prevent stress fractures among recruits. Six males were followed during 8-week army basic training at Fort Bliss, Texas in 1989. According to the authors, musculoskeletal injury is common in basic training, with reports of clinic visits for injury occurring in 15% to 31% of male recruits. Stress fractures, described as an overuse injury, are a common occurrence in physical fitness programs; and have been associated with the rigors of marching, drilling, and running. In this study, a modified program was designed to evaluate whether resting from running for 1 week during the second, third, or fourth week of intensive physical conditioning in the basic training program would reduce the occurrence or severity of stress fracture and other injuries. The results of the study did not demonstrate that resting reduced the incidence of stress fractures, given the wide variation in the amounts of physical training that was observed in recruits.

**[14] Title: There's Safety in Numbers**

**Authors:** Rosenberg, Mark

**Source:** American journal of preventive medicine, 2000, 18(3 Suppl): 6-7

**Summary/Abstract:** This article introduces a series of articles that were published in this issue (and others) of the American journal of preventive medicine addressing the issues of injuries in the military-determining the existence and causes, and prevention methods. The underlying causes and risk factors for most injuries among military personnel are similar to those experienced by the civilian population. Quite a few researchers uncovered that injuries are the most important health problem for young military population. So the authors; goal is to illustrate the commonalities among the two groups, and to learn as much about injury trends of civilians by analyzing the military population. Many of the articles mentioned in this article have been summarized for this literature review, and include, Jones, Powell, Smith, Altarac, and Bell to name a few.

**[15] Title: Non-Battle Injury Casualties During the Persian Gulf War and Other Deployments**

**Authors:** Writer, James

**Source:** American journal of preventive medicine, 2000, 18(3 Suppl): 64-70

**Summary/Abstract:** This article reviews injury occurrences and evaluates injury surveillance systems used on deployments of US military personnel in 1994. Data was collected and evaluated during deployments to Hati, Egypt, and Somalia during the Persian Gulf War via (military) administrative databases. The results of the study showed that injuries were the leading cause of death, hospital admissions, and outpatient visits among troops. The data obtained from surveillance systems was used to advise commanders on the readiness of their forces, however was too general for evaluating specific types or causes of injuries. The authors went on to make recommendations for strengthening the systems that are in place.

**[16] Title: Profile of Psychiatric Disorders in the Sri Lanka Air Force and the Outcome at 6 months**

**Authors:** Hemamali, Perara and Thirupathy Suveendran

**Source:** Military Medicine, May 2004, 169: 396-399

**Summary/Abstract:** This purpose of this study is to identify the mental health needs of military personnel. The Sri Lanka Air Force (SLAF) does not have its own mental health care facilities and relies on the civilian health sector for assistance. According to the authors, the stress involved in serving in the military promotes the onset of mental illness. Depression and suicidal ideation, adjustment disorder, anxiety, posttraumatic stress disorder, alcohol and drug abuse, and personality difficulties are some common mental health problems seen among military personnel. [16]

For the study, 76 military persons were seen as outpatients, all were men between 18 and 50 years of age. Although this statistic is specifically describing work conditions for SLAF, I think it is still an accurate representation of the global military workforce.

**[17] Title: Prevalence of Psychotic Comorbidity in Combat-Related Post traumatic Stress Disorder**

**Authors:** Kozaric-Kovacic, Dragica, and Andreja Borovecki

**Source:** Military Medicine, March 2005, 170: 223-226

**Summary/Abstract:** The purpose of this study is to explore the prevalence of psychotic symptoms among Croatian war veterans with combat-related PTSD. The study included 680 men who had experienced combat stress and had diagnosed with PTSD. According to the authors, a recent epidemiological survey indicated that approximately 80% of individuals with PTSD meet criteria for at least one psychiatric diagnosis. The most frequent diagnoses are major depressive disorder, other anxiety disorders, substance abuse, somatization, personality disorders, and dissociative disorders.

**[18] Title: Mental Health Evaluations of US Air Force Basic Military Training and Technical Training Students**

**Authors:** Capt. David Englert, USAF BSC; Capt Christopher L. Hunter, USAF BSC

**Source:** Military Medicine, November 2003, 168: 904-910

**Summary/Abstract:** This study looked at the attrition of US Air force basic military trainees and technical school students due to mental health disorders in 2001. 1680 basic trainees and 338 technical school students who were seen at the Behavioral Analysis Service (BAS) from January 2001 to December 2001 were used for this report, represented all racial and ethnic backgrounds, and 226 of the participants were men. The goal is to examine the mental health related disorders that are prevalent with basic training and technical school students who are separated from the Air Force within the first year. Approximately one third of USAF enlisted fail to complete basic military training, and a large number of them are separated from active duty service due to mental health-related disorders; which results in a loss of approximately \$46,000 per individual in recruitment and training costs.

**[19] Title: Stress fracture injury in young military men and women**

**Authors:** Armstrong III, David W., John-Paul H. Rue

**Source:** Bone 35 (2004) 806– 816

**Summary/Abstract:** The purpose of this study was to compare young men and women at the United States Naval Academy who sustained lower extremity stress fracture during a military summer training program with a matched group of uninjured recruits to identify factors that may increase the risk of a stress fracture. This physical training program, consisting of early morning runs (approximately 10 mi per week;) and calisthenics (60–90 min of stretching, push-ups, sit-ups, pull-ups, sprinting, and agility drills) 5 days a week, initiates changes in metabolic events that contribute to a loss of body weight in some recruits. Stress fractures, also known as fatigue or march fractures, have remained a well-recognized medical condition since Breithaupt initially described them in 1855. Stress fracture injuries are ubiquitous among military organizations and disproportionately affect women . Within the U.S. military, reported rates for stress fracture among new recruits range from 2% to 12%, contributing to substantial lost training time.

**[20] Title: Sports and Physical Training Injury Hospitalizations in the Army**

**Authors:** Lauder, Tamara D., Susan P. Baker

**Source:** American journal of preventive medicine, 18(3S): 118–128) 2000

**Summary/Abstract:** An Army database of all hospital admissions for active duty Army personnel in the 1989–1994 period was used to study injuries resulting from sports and Army physical training. For the 6-year time period reviewed, there were 13,861 hospital admissions for injuries resulting from sports or Army physical training: 94% (13,020) of these admissions were men and 6% (841) were women. The rates of sports injuries were 38 and 18 per 10,000 person-years for men and women, respectively. Sports injuries accounted for an average of 29,435 lost duty days each year: Men lost an average of 13 days per injury and women lost an average of 11 days per injury.

**[21] Title: Women, Work and Musculoskeletal Health**

**Authors:** Strazdins, Lyndall and Gabriele Bammer

**Source:** Social Science & Medicine 58 (2004) 997–1005

**Summary/Abstract:** This study examines gender differences in work-related (civilian) health conditions, and to address the question why employed women are much more likely than men to experience upper body musculoskeletal disorders. A mailed self-report survey gathered data from 737 Australian Public Service employees (73% women). The majority of respondents were clerical workers (73%). Eighty one per cent reported some upper body symptoms; of these, 20% reported severe and continuous upper body pain. He proposes that domestic work and stress from overload further exacerbate musculoskeletal disorders because they interfere with the recovery process.

**[22] Title: Injury prevention during physical activity in the Australian Defence [Defense] Force**

**Authors:** Sherrard, J., Lenne, M., Stokes, M. and Ozanne-Smith, J.

**Source:** Journal of Science & Medicine Sports, (2004), 7(1) 106-117

**Summary/Abstract:** This paper examined the major findings from a commissioned review of injuries sustained by Australian defense force (ADF) personnel during non-combat military training and sports activities in 2001. Injuries sustained by personnel have been associated with high numbers of working days lost, hospitalization days, sick days, light duty days and reduced deployability. For the ADF, the major cause of non-combatant injury is sports activity; rugby, touch football, and soccer. The authors conducted searches of computerized databases of published literature regarding disability and exercise as it relates to the military, in order to assess the injury prevention measures that were recommended. Authors found that the major injury risk factors during military training include older age, female gender, greater amounts of running, low levels of physical activity/sedentary lifestyle, low levels of aerobic fitness/ performance, previous injury history, and highly rigorous specialized training. Researchers proposed that recommendations for improved injury coding and surveillance systems for the US military were equally applicable to ADF. It can be said that existing recommendations made from studies that have been published by the medical community here in the US have a great deal of validity if recognized. Sherrard, et. al. (2004) found that the most promising method of improving physical fitness levels while minimizing injury risk to military recruits may be to modify basic training programs. Furthermore, (optimal) training should be identified for individuals of different fitness and performance levels so that the high injury risk due to over training can be avoided while maintaining the required level of physical fitness. Authors also suggested the use of deep water running as a strategy for maintaining fitness levels in injured personnel. The authors also recommend that implementing more detailed data collection techniques for military personnel would better inform injury prevention programs.

**[23] Title: The etiology of low back pain in military helicopter aviators: Prevention and treatment**

**Authors:** Pelham, Thomas, White, Harold

**Source:** Work (2005), 24(1) 101-110

**Summary/Abstract:** Low back pain is a major health problem among military rotary-wing aircrews worldwide. In-flight sitting posture and vibration generated by aircraft were identified as high risk factors for LBP. As a result, researchers recommended ergonomic modifications to the crew stations. Research suggests, but has not yet proven, that a significant percentage of LBP can be prevented with good posture, abdominal strength, and flexibility. Research performed in the United States found that operational activities are one of the most common causes of injury requiring patient care and necessitating limitations on duties. According to a United States Navy study, a higher incidence of LBP was found in pilots versus other members of the aircrew.

Researchers concluded that the in-flight sitting posture, over prolonged flights, is the main etiologic factor for back pain among pilots. More specifically, the confined workstation for the engineer/gunner operating the HH-60G, was found to contribute to LBP. Furthermore, back pain while flying has been suggested to interfere with operational readiness and flying performance. Pilots have reported difficulties concentrating during flights, and rushing through flights due to LBP.



The authors recommend using a pre and post flight exercise protocol for pilots that has been prescribed by a physical therapist at Canadian Forces (CF) Base Shearwater. The program is based on proprioceptive neuromuscular facilitation (PNF) stretching; and consists of exercises focusing on six important muscle groups, the hip flexors, hip lateral rotators/abductors, hip extensors/hamstrings, calf and anterior chest. Another successful flight-specific program used by CF physical therapists to treat LBP is water therapy. The viscosity of water acts as resistance for the moving body. The advantage of water resistance in the development of strength is that the individual does not have to conform to the restrictions of the strength machine, but can move in the desired functional movement with the correct posture.

**[24] Title: The Use of Existing Military Administrative and Health Databases for Injury Surveillance and Research**

**Authors:** Lincoln, Andrew, Smith, Gordon.

**Source:** American journal of preventive medicine, 2000 Apr, 18(3 Suppl):8-13

**Summary/Abstract:** This paper discusses the inconsistencies in how data is collected when injuries occur in the military, and cite this incongruity as one of the major reasons that information is not available for active duty officers. They liken the 1.5 million members of the services, predominantly young adults, to civilian populations in that they are subject to many of the same hazards that cause injuries (to civilians) in the course of work, travel, and recreation. According to authors, the *Atlas of Injuries in the U.S. Armed Forces* by the Department of Defense (DoD) Injury Surveillance and Prevention Work Group was a first step in recognizing the importance of injuries to the Armed Forces, because it clearly identified the value of medical surveillance databases in the military.

Research performed by Lincoln (2000) et al., found that injuries accounted for 81% of all deaths in the military during FY 1996. When deaths occur in the military, as compared to civilian deaths; cause-of-death data coded on the death certificate is not available except those occurring in military hospitals. This is a major deficiency in otherwise good quality data available in the military. Other findings in their research showed that military surveillance data could provide useful information relating to injuries. For example, (military) hospitalization data was used to determine that women have a 3.9-fold greater risk of injury resulting in hospitalization than men, given the exposures associated with Army cadet basic training. This information is used to focus prevention efforts on high-risk groups (i.e., women); and to further demonstrate how injury patterns differ between the two genders.

The paper further discussed the (STANAG – NATO Standard Agreement 2050) trauma code, which was designed to designate an injury occurring during a work shift. Additionally, duty status is not a separate variable in Army hospitalization data. It is combined with the “intent” of injury to produce a “trauma code” that includes codes for accidental injury (off duty, exercises, other scheduled training, on duty, and unknown whether on or off duty). Authors maintain that there should be separate codes for intent and duty status in order to capture the full disposition (scope) of injuries. Their research also found that fatalities are well reported, but nonfatal injuries are not. Moreover, since injuries are an undesirable occurrence, unit leaders—like civilian managers—may have a

disincentive to report them. One of the most important unmet needs identified is for an automated, DoD-wide outpatient data system with a minimum data set that includes age, race/ethnicity, gender, diagnosis, cause, and circumstances of injury. Cause-of-injury codes should be included in all hospitalization records, including admissions classified within the ICD subgroup of musculoskeletal conditions, none of which presently receive cause codes unless there is an acute injury diagnosis in a secondary field. Data on at-work injuries should be included in this and be a required data field such that, if the trauma code indicates unknown duty status, follow-back inquiries are made.

**[25] Title: Viewpoint: A Comparison of Cause-of-Injury Coding in U.S. Military and Civilian Hospitals**

**Authors:** Amoroso, Paul J., Bell, Nicole S., Smith, Gordon S.

**Source:** American journal of preventive medicine, 2000 Apr, 18(3 Suppl):164-173

**Summary/Abstract:** The purpose of this paper is to describe the STANAG system, subjectively discuss its strengths and weaknesses relative to the ICD-9-CM (system used by civilian hospitals) and draft ICD-10-CM systems of external cause of injury coding, and make policy recommendations about future coding of military injuries applicable to the full spectrum of injury severity including fatalities, hospitalizations, and outpatient visits.

The STANAG injury coding system, unlike the ICD, uses two components, or axes, to code intent and cause/activity. For some types of injuries there are also subcodes that indicate the place where the injury occurred. The STANAG (NATO Standard Agreement 2050) system begins with a Trauma code—a single-digit code with 10 possible values intended to specify the intent and work-relatedness of an injury. The Trauma code distinguishes among battle-related, non-battle related intentional, and non-battle related unintentional injuries. It also provides information about whether the injury occurred while the person was on or off duty and whether the on-duty activity was specific to certain training activities or exercises. The injury is next assigned a three-digit injury code that indicates the activity or event leading to the injury.

Authors make recommendations for improving the coding of injuries in the military: either revise the STANAG to improve and expand the existing coding frame, or adopt another system for categorizing injury causes. In comparing the current system to the one used by civilians, the present system does a poor job of coding peacetime injuries, which in recent history have represented the greatest costs and have been the chief cause of lost readiness. In summary, the STANAG (NATO Standard Agreement 2050) system has served the U.S. military well over the past 40 years, but it is not as robust as the draft ICD-10-CM. The military needs a system for coding cause-of-injury data that distinguishes among different types of non-war-related injuries with more clarity and specificity than the current iteration of the STANAG, and that will permit meaningful comparison with civilian hospital data. Reliable, accurate, and detailed coding is essential to the effective management, tracking and prevention of injuries in the military.

**[26] Title: Sudden Death in Young Adults: A 25-Year Review of Autopsies in Military Recruits**

**Authors:** Eckart, Robert. E, Scoville, Stephanie, Campbell, Charles L.

**Source:** Annals of Internal Medicine, 2004 141:829-834.

**Summary/Abstract:** The purpose of this retrospective study was to determine the causes of nontraumatic sudden death among a cohort of military recruits. Authors used demographic and autopsy data from the Department of Defense Recruit Mortality Registry, DoD-RMR, for military recruits over a 25-year period (1977 through 2001). The registry reflects a review of military personnel records and investigative reports, death certificates and autopsies, and Armed Forces Institute of Pathology consultations and toxicology studies. The DoD-RMR considers a death to be a recruit death if the fatal incident occurred at a military training site before completion of initial training while the recruit was in an enlisted status in the Air Force, Army, Marine Corps, or Navy.

The authors stated that most sudden deaths among apparently healthy young athletes occur during exertion and are most often caused by cardiac abnormalities. Gardner and colleagues are quoted to have reported that 60% to 78% of exercise-related deaths in U.S. military personnel during 1996–1999 were attributable to a cardiac cause. Furthermore, Phillips and colleagues were said to have identified 19 sudden cardiac deaths from 1965 through 1985 during Air Force basic military training at Lackland Air Force Base, Texas, the only training site for Air Force basic military training. Deaths occurring during basic military training are of particular concern because they occur despite a pre-enlistment health screening program and have a substantial effect on the structure of basic training.

The results of the analysis show that The DoD-RMR contained 277 deaths identified from among 6.3 million recruits from 1977 through 2001. The median age of the recruits was 19 years (range, 17 to 35 years), and 111 (88%) were male. The rate of nontraumatic sudden death was 13.0 per 100 000 recruit-years, a figure that did not vary significantly over the 25-year study period. Approximately half (64 of 126 recruits) of the nontraumatic sudden deaths were due to an identifiable cardiac abnormality, and slightly more than one third (44 of 126 recruits) were idiopathic. [page 831] Researchers also found that over a 25-year period, 86% of sudden nontraumatic deaths among military recruits were related to exercise. Although cardiac causes were attributed to half (51%) of the sudden deaths. They further postulate that in order to avoid lost training days or disqualification from military service, the recruits may not have disclosed these symptoms before the fatal incident, which suggests that guidelines be set in place for physical examinations & screenings of new recruits. Based on the results of this study, the authors recommend that screening for anomalous coronary arteries with an imaging technique (echocardiography, computed tomography, or magnetic resonance imaging) be strongly considered in any young patient initiating an exercise program who presents with symptoms that may be referable to cardiovascular disease. [page 832]

**[27] Title: The role of human factors engineering in establishing occupational fitness standards**

**Authors:** Kuruganti, U., Rickards, J.

**Source:** International Journal of Industrial Ergonomics 34 (2004) 451–457

**Summary/Abstract:** This paper examines the current practices used to develop job task requirements in the traditionally male-dominated occupations of firefighter, police officer and armed forces personnel and the role of task analysis. A case study of a local firefighting unit is presented in the context of task analysis. The authors begin by defining human factors engineering. Human factors engineering (HFE) is the study of the impact of workplace design, and workplace environment, on people and includes those issues that have an impact on the body's structure and functioning. The goal of HFE is to assure the personal health, wellness and safety of people in their workplace, while enhancing their productivity.

Occupational fitness standards vary according to the type of job. In traditionally male-dominated areas such as police officers, firefighters and the armed forces, guidelines were established without considering the possibility of women recruits. As society has changed, and more and more women begin to enter these professions, there is a concern that reducing the physical requirements to accommodate female recruits will result in reduced public safety. There is a lack of awareness regarding how occupational fitness tests are developed. Often when a human rights case is made the public perception is that in order to ensure equality of men and women the public safety is compromised. One of the problems with the current practices is the lack of consistency between municipalities and provinces in regards to their occupational fitness tests. Often the occupational fitness tests appear to have been developed, but with minimal re-examination as technology changes. The authors feel that appropriate task analysis is key to the development of suitable occupational fitness tests. Task analysis is a process of identifying and describing units of work, and analyzing the resources required for successful work performance. This human factors technique could be very useful in redesigning military fitness programs.

**[28] Title: Military Training-Related Injuries Surveillance, Research, and Prevention**

**Authors:** Kenton R. Kaufman, PhD, Stephanie Brodine, MD, Richard Shaffer, PhD

**Source:** American journal of preventive medicine, 2000;18(3Suppl) 54-63

**Summary/Abstract:** This article reviews epidemiologic literature on musculoskeletal injury rates; injury type and location; and risk factors for military populations. Suggestions for injury surveillance and prevention are also offered. Information presented to the Armed Forces Epidemiological Board's (AFEB) Injury Control Work Group by scientists from the Navy and Army research organizations was evaluated by researchers. They postulate that the majority of injuries that occur as a result of military training (PT) are lower extremity musculoskeletal injuries. Further, the majority of the injuries associated with military training occur at or below the knee. The data also suggest that female trainees in any given study experience about twice the incidence of musculoskeletal injury during training as their male counterparts. Further, the data suggest that women are at a 1.2 to 10.0 times greater risk of suffering bone stress injuries

as men in U.S. military training populations. However, it has been demonstrated recently that the increased injury rates among women may be due more to lower levels of fitness at the time of entry into training.

The authors make a very relevant point in that injuries are important in terms of loss of time from work and training and decreased military readiness. Their research has shown that training costs for military personnel are staggering. It has been estimated that injuries among 22,000 male recruits during 12 weeks of basic training at MCRD, San Diego, result in more than 53,000 lost training days and cost more than \$16.5 million per year. The following table further illustrates this point.

Table B-2. Average limited duty days by type of musculoskeletal injury among infantry soldiers. (Kenton, *et. al.*, 2000).

Injury	Limited duty (days/injury)
Fractures	103.2
Sprains	16.7
Other traumatic injuries	7.6
Tendinitis	7.0
Strains	3.0
Musculoskeletal pain	2.8

Source: Knapik J, Ang P, Reynolds K, Jones B. Physical fitness, age, and injury incidence in infantry soldiers. *J Occup Med* 1993;35:598–603.

If the pay rate per day is known, the actual loss of work day time can be calculated for the United States Air force. The authors provide some strategies for preventing musculoskeletal injuries. The most effective way to improve the level of physical fitness may be to alter the training regimen by increasing the duration, frequency, and intensity of the initial training events gradually. This approach accommodates the incoming, poorly fit recruits without compromising the fitness of the graduating recruits. To reduce injuries and maintain fitness of Marine recruits, the San Diego MCRD conducted a training intervention trial. The intervention included reduction in the amount of running miles, gradual build-up of exercise and military hiking, and emphasis on aerobic activities in early training phases before progressing to anaerobic activities and strength conditioning. Evaluation of this intervention demonstrated a significant reduction in all overuse type injuries. Lower extremity stress fractures were reduced by 55%, which resulted in 370 fewer stress fractures per year with a cost savings of over \$4.5 million at the San Diego MCRD.

Other recommendations made by the authors include:

- Include in the minimum data set for outpatient care at least the following: age, race/ethnicity, gender, diagnosis, profile/disposition, and cause. Cause data are particularly important for prevention efforts.
- Focus research on high-risk populations and environments with the largest impact on readiness.
- Routinely document incidence, severity, time lost, and costs of outpatient injury events.
- Conduct research to study the effect of equipment design, especially footwear, on training and injuries.
- Broaden research effort to more than basic training, infantry, and Special Forces.
- Research on physical training practices should concentrate on the intensity, frequency, and duration of training, as well as the type of activity.
- Continue to explore the association of training, fitness, performance, smoking, and other modifiable risk factors with injuries.
- Implement and monitor effectiveness of prevention strategies using surveillance systems.

**[29] Title: Case–Control Study of Discharge from the U.S. Army for Disabling Occupational Knee Injury The Role of Gender, Race/Ethnicity, and Age**

**Authors:** Sandra I. Sulsky, MPH, Kenneth A. Mundt, PhD, Carol Bigelow, PhD, Paul J. Amoroso, MD, MPH

**Source:** American journal of preventive medicine, 2000;18(3Suppl) 54-63

**Summary/Abstract:** This study examined the separate and joint roles of gender, race/ethnicity, and age in the odds of discharge from the Army for disabling knee injury. Authors suggest that occupational injuries are responsible for more lost time from work, lost productivity, and lost working years of life than any other health condition in either the civilian sector or the peacetime Army. A total of 860 women and 7868 men were discharged from the Army between 1980 and 1995 for knee-related disability and met all inclusion criteria for this study. The authors focused on disability discharge in order to identify severe injuries. The objective was to determine the separate and joint roles of age, gender, and race/ethnicity differences in the odds of knee-related disability discharge from the Army, as these sociodemographic characteristics are likely to be important variables in future analyses of occupational knee injury.

The results of this study showed that Caucasian women were at higher risk than Caucasian men at all ages except for the 23–27 year age group, and non-Caucasian women were at lower risk than non-Caucasian men at all ages except for the 30–54 year age group; however, the effect of age was least strong for Caucasian women. Furthermore, non-Caucasians were at lower risk than Caucasians at all ages and among both men and women. The effect of race was consistent over all age groups.

**[30] Title: The Role of Sexual Assault on the Risk of PTSD among Gulf War Veterans**

**Authors:** Han Kang, DRPH, Nancy Dalager, MS, Clare Mahan, PHD, and Erick Ishill, PHD

**Source:** Annals Epidemiological, 2005;15, p.191-195

**Summary/Abstract:** Authors of one study that were cited in this paper stated that certain characteristics of the military setting such as high male to female ratios, traditional male environments, and predominance of male supervisors may be factors that have increased the likelihood of sexually harassing behavior. The role of sexual harassment and assault as predictors of PTSD symptoms was examined among a population-based sample of female US Gulf War military personnel. Among 1307 men and 197 women who served in the Somalia peacekeeping mission, both combat and sexual abuses were significant factors in the development of PTSD for men as well as women. PTSD is of importance to assess potential problems associated with the deployment of male and female service members together into future battlefields.

Using the National Health Survey data, authors evaluated the association between the reported sexual harassment/assault during the Gulf War deployment and the risk of PTSD. Data was obtained from the National Health Survey of Gulf War Era Veterans and Their Families. The survey population consisted of 15,000 Gulf War veterans and 15,000 non-Gulf veterans. A brief screening instrument for PTSD, was also included in the questionnaire. In this study, sexual assault, harassment, and combat experience were each determined from the self-reported responses to the survey questionnaire.

The results of the survey analysis, which was targeted toward 15,000 Gulf War veterans, only 11,441 (76.3%) responded by mail or telephone to the survey and were included in these analyses. Overall, nearly 24% of the females reported a history of sexual harassment and 3.3% of the females reported a history of sexual assault. The study results suggest that given the same traumatic experience whether combat related or involving some form of sexual abuse, the risk for PTSD will be similar for both genders.

**[31] Title: The Occupational Burden of Mental Disorders in the U.S. Military: Psychiatric Hospitalizations, Involuntary Separations, and Disability**

**Authors:** Charles W Hoge; Holly E Toboni; Stephen C Messer; Nicole Bell; et al

**Source:** The American Journal of Psychiatry; Mar 2005; 162, 3; (ProQuest Nursing Journals), pg. 585-591

**Summary/Abstract:** The purpose of this study was to characterize the risk and reasons for service separation for soldiers hospitalized with mental disorders compared with those hospitalized for other illnesses. Authors followed a cohort of 13,971 U.S Army soldiers first hospitalized in 1998 and followed them for up to 2 years.

The results of the study showed that the rate of service separation 6 months after first hospitalization was 45% among personnel whose primary hospital discharge diagnosis was a mental disorder; 27% among those with secondary mental disorder; and 11% among those hospitalized for all other medical conditions.

**[32] Title: Risk factors for occupational knee-related disability among enlisted women in the U.S Army**

**Authors:** Sulsky, S.I, and Mundt, K.A.

**Source:** Occupational Environmental Medicine; 2002, Vol. 59, p601-607

**Summary/Abstract:** The aim of this research article is to identify sociodemographic and occupational determinants of knee related disability discharge from the US Army among enlisted women, and investigate effect modification. The authors conducted a case control study on 692 cases within a population of 244,000 enlisted women from 1980-1997. The authors felt that since most military jobs are also represented in the civilian sector; risk factors for occupational disability identified in the Army should also pertain to civilian workers. The disposition of knee injuries is highlighted in the following table below:

Table B-3. Knee related disabilities and case counts fro enlisted women in the US Army, based on Veteran's Administration System for Rating Disability (VASRD) codes, 1980-1997. Recreated based on Sulsky & Mundt (2002).

Disability name	All cases		Analysis set	
	n	%	n	%
Recurrent subluxation or lateral instability of knee	635	63.5	459	65.38
Impairment of femur*	188	18.8	129	18.38
Impairment of tibia and fibula**	116	11.6	71	10.11
Removal of semilunar cartilage	44	4.40	32	4.56
Genu recurvatum	6	0.60	3	0.43
Dislocation of semilunar cartilage	7	0.70	1	0.14
Knee replacement	1	0.10	1	0.14
Thigh amputation	1	0.10	0	0.00
Ankylosis of knee	0	0.00	0	0.00
Amputation with loss of extrinsic pelvic girdle muscles	0	0.00	0	0.00
Amputation 1/3 of the distance from the perineum to the knee	2	0.20	2	0.28
Total	1000	100	702	100

\* includes malunion of femur with knee or hip disability

\*\* includes malunion with knee or ankle instability

The results of the study showed that cases were more likely to be white and more likely to be unmarried compared to controls. Controls were defined as a simple random sample from the population of all enlisted women with a record in the personnel file for a given year. The study also found that because of their shorter service history, cases were more likely to be among the lower pay grades (E1-E3). The most common career management fields for cases in this study were support/administration, service/supply, and health care. Injuries were most prevalent among the electrical/mechanical equipment repair, and craftworkers. Futher, the study found that non-white, married, longer duration of service, and higher pay grade were associated with lower risk of knee related disability



discharge. The implications of this research are that sociodemographic factors (race, marital status, etc.) had larger effects than occupational characteristics (type of job) on risk of knew related disability discharge from the US Army.

**[33] Title: Separation or Retirement for Physical Disability**

**Authors:** Blanchard, G.

**Source:** Department of Defense Directive Number 1332.18, November 4, 1996.

**Summary/Abstract:** This directive reissues DoD Directive 1332.18 dated February 25, 1986, to update policy and responsibilities for separation or retirement for physical disability under several titles of USC. Section c of this document is of interest to this research. This section states that, according to the policy of the DoD, the disability evaluation system shall be the mechanism for implementing retirement or separation because of physical disability in accordance with Chapter 61 of 10 USC; and shall consist of four elements:

- Medical evaluation
- Physical disability evaluation
- Counseling
- Final disposition

The policy also explains that members of military should be examined for physical fitness every five years. Ideally, an active adult male or female should be examined more frequently. In fact, according to an article published in WebMD Medical News, standardized annual physical exams may not be necessary, although they are still strongly supported by phycisians and patients. However, individualized preventive care may address a patient's specific medical needs.

**[34] Title: Physical Disability Evaluation**

**Author:** Hill, A.

**Source:** Technical Report, November 1996

**Summary/Abstract:** This document implements policy, assigns responsibilities, and prescribes procedures under DoD Directive 1332.18 and Title 10, U.S Code for retiring or separating Service Members because of physical disability. It relates directly to the previously summarized document, "Separation or Retirement for Physical Disability." The four elements of the disability evaluation system are medical evaluation by medical evaluation board (MEB) to determine the injury and/or illness; physical disability evaluation by physical evaluation board (PEB) to determine the fitness of service members to perform their military duties; service member counseling and final disposition by appropriate personnel authorities.

One aspect of the document that was not very clear was that referrals for members with non-duty related impairments are made upon request of the member or when directed under Service regulations. Referrals are only for the determination of fitness for duty. Based on this guideline, one would assume that service members with non-duty related impairments would not receive compensation for their injuries. [page 3-14]

Part 4 [page 3-21] discusses standards for determining compensation for disabilities. Under this standard, members who are determined unfit shall be retired or separated with disability benefits when:

- The physical disability is not the result of the member's intentional misconduct or willful neglect and was not incurred during a period of unauthorized absence or excess leave, and
- The physical disability was incurred or aggravated while on active duty, annual training, or other full time duty under call or order that specifies a period of 30 days or less.

The document further provides a detailed list of medical and physical conditions which should be referred to the DES [49-72].

**[35] Title: The natural history and risk factors of musculoskeletal conditions resulting in disability among US Army personnel.**

**Authors:** Lincoln, Andrew.

**Source:** Work; 2002, Vol. 18, p. 99-113

**Summary/Abstract:** The purpose of this study was to describe the natural history of common musculoskeletal conditions requiring hospitalization of Army personnel; and to identify those factors that are most strongly associated with disability discharge. The author agrees with previously stated definitions of disability according to the medical evaluation board in 1997. Authors performed a retrospective study, which followed active-duty Army personnel from their initial (musculoskeletal) hospitalization, through the development of physical disability, between the years of 1989 and 1996.

In examining data obtained from the Total Army Injury and Health Outcomes Database (TAIHOD). The results of bivariate analyses on the data found that disability rates highest among the following subgroups: 21-25 year olds; enlisted personnel in the lowest pay grades (E1-E3); those in the service for 6 months or 7-12 months; etc. [103] The authors found that the risk of disability was highest for the three back conditions: intervertebral disc displacement, intervertebral disc degeneration, and nonspecific back pain. Through analysis, it was found that greater disability risk increased with age, and was highly correlated with service time; and frequently experiencing work stress was associated with increased risk of disability.

One observation that the author failed to note was the inconsistency in how musculoskeletal disorders and sprains/strains were coded in this particular database. The injuries were divided into four functional groups, with different diagnostic categories. The four groups were:

- Back conditions
- Knee conditions
- Overuse conditions
- Other MS conditions

**[36] Title: Injury and Illness Among Air Force Female Military: Final Report, April 1996.**

**Authors:** Snedecor, M.R., Boudreau, C.F

**Summary/Abstract:** This report preceded the journal article that was published by the authors titled “U.S. Air force recruit injury and health study,” in the American journal of preventive medicine (2000). The study was called “The Female Recruit Morbidity Study” and was conducted by the US Air Force Office for Prevention and Health Services Assessment (OPHSA) between October 1994 and June 1995. During the study period, female recruits were matched with a cohort of male recruits and followed through BMT to obtain data on injuries and illnesses for which medical care was sought. The results of the study can be used for military commanders and medical managers to make recommendations for meeting the health needs of female military personnel. The study duration was broken into two-month time periods to stratify for environmental exposures. [pg 9] The results concluded that female recruits were at higher risk for injury during basic training, for various reasons that may *not* be physiologically gender-specific, but more to do with pre-enlistment physical conditioning. The researchers found that when gender-specific illnesses are excluded, female recruits have the same risk for illness as males. The methodology of the experiment is further described in this document beginning on page 14.

**[37] Title: DOD DISABILITY: Overview of Compensation Program for Service Members Unfit for Duty, April 2001.** GAO report to the chairman committee on armed services, House of Representatives. GAO-01-622.

**Summary/Abstract:** This report was compiled for the chairman, committee on armed services, House of Representatives. Authors examined how DOD administers its disability severance pay for service members with less severe disabilities and the associated administrative costs and coordination issues; and the extent to which the military services provide financial counseling to service members receiving disability severance (lump-sum) payments. DOD and service-level officials were interviewed and pertinent DOD and service-level documents were examined. They found that the administration of disability severance, like medical retirement pay, follows service-specific procedures using DOD guidance. The services assess members’ fitness for duty along a scale ranging from 0 to 100 percent in gradations of 10. Members unfit for duty receive retirement payment. In contrast, a lump-sum disability severance payment is made to members unfit for duty who have less than 20 years of military service and who are assigned a disability rating less than 30 percent. In fiscal year 2000, the number of assessments resulting in disability severance payment was more than double the number of assessments resulting in medical retirement. The services and DOD could not provide extant data on how much it costs to make disability decisions or issue payments or how long it takes. However, service-level officials had some concern about the long lead time that can elapse before a service member with an injury or illness formally enters the disability evaluation system who have 20 or more years of military service with any disability rating or who are assigned a disability rating of 30 percent or higher receive medical.

This document provides the following information & statistics on disability claims:

1.Types of DOD Disability Compensation include [page 8]:

- Medical Retirement
  - A monthly payment paid for life
  - members unfit for duty who have 20 or more years of military service with any disability rating or who are assigned a disability rating of 30 percent or higher per VA's Schedule for Rating Disabilities with any length of service
- Disability Severance
  - A one-time lump-sum payment
  - members unfit for duty who have less than 20 years of military service and who are assigned a disability rating of less than 30 percent

2. Calculation of Disability Compensation

- Medical Retirement
- Higher of:
  - (1) Disability Rating x Retired Monthly Base Pay\* or
  - (2) Years of Service x 2.5 x Retired Monthly Base Pay
- Severance Pay
- Monthly Base Pay x 2 x Years of Service (up to a maximum of 12 years)

3. Approximate Financial Outlays (FY'00)

- \$1.27 Billion in Medical Retirement Pay
  - The average retiree received \$13,060 for the year the average officer retiree received \$24,260
  - the average enlisted retiree received \$8,380
- \$159 Million in Disability Severance Pay
- The average member received \$18,725 as a lump-sum payment
  - the average officer received \$51,065
  - the average enlisted member received \$17,750

According to the report, the disposition of cases in fiscal year 2000:[page 15]

Return to Duty.....	18%
Separation with Severance Pay.....	35%
Medical Retirement.....	14%
Temporary Disability Retirement List.....	24%
• Medical Retirement-eligible and disability not stable	
• 5-year tenure maximum; periodic re-exams (18 months)	
• minimum 50% base pay	
Other .....	9%

**[38] Audit Report: Medical Disability Discharge Procedures, DoD, June 8, 1992. Report #92-100. Office of the Inspector General.**

**Summary/Abstract:** The objectives of the audit were to determine whether military members identified as medically disabled were expeditiously discharged from the services, and to assess the effectiveness of the discharge process and related internal controls.

From the audit, authors determined that the DoD disability system was not efficient or economical; disability cases were not processed promptly, and personnel were incorrectly rated for their disabilities, and were paid excessive compensation. [page 6] Authors predicted that the DoD would spend approximately \$839.3 million during 1993-1998; and could avoid this cost by improving its disability system operations. For disability processing, the processing time averaged 147.9 days from disability identification to the date of separation from service. [page 19] According to authors, the DoD standard is actually 20 days for processing discharges, and have not established standards to ensure that this constraint is met. The DoD does not have a standard for processing medical evaluations, so no internal controls existed (during this audit) to ensure prompt processing. The Army established a 30 day standard for processing the results of medical boards; however the Navy and Air Force had not established a standard processing time. At the same time, the Air Force did exceed the DoD's 20-day standard in processing discharges due to its automated system.

The audit found that 23% of disability cases were incorrectly rated by the physical evaluation boards [page 21]. Several factors related to this deficiency were discussed, and included: training of PEB members, documentation of the PEB, approval of 9.6 % cases with prior-to-service conditions, 3.1 % resulted from active duty members's misconduct or neglect (drugs, alcohol, excessive behaviors, etc.) The remainder of the document discusses recommendations to DoD directives.

**[39] Title: Long-Term Outcomes of Veterans Discharged with Disabilities from the U.S Army**

**Principal Investigators:** Steven Wright, Paul Amoroso

**Source:** Annual Report, U.S Army Medical Research & Material Command, October 2001

**Summary/Abstract:** This report is part of a retrospective study of veterans who were discharged with a disability from the military between 1985-1999. The disposition of discharges include those with knee or back related injuries, or hospitalization. The purpose of the study was to compare a sample of the aforementioned veterans to those discharged without any disability or hospitalization. Investigators used the Army's TAIHOD database to obtain subjects for the study. Unfortunately, the study was not complete as of the date of the report, so no additional information was provided in this document.

**[40] Title: Predictors of Back Injury Among Women Military Recruits**

**Principal Investigator:** Michael Weaver

**Source:** Annual Report, U.S Army Medical Research & Material Command, November 1999

**Summary/Abstract:** The purpose of this prospective, non-experimental study of female recruits are to recommend exercise and educational interventions for reducing the incidence of back injury; identify risk factors for back injury and discomfort by testing several variables which include aerobic capacity, upper body strength, lower body strength, functional lifting ability, hamstring flexibility, body composition, smoking status, previous back injury, back knowledge, life satisfaction, and demographic factors; describe the distribution of types of back injuries which occur in women recruits and the basic training tasks which are leading causes of back injury in that group of recruits. According to the author, mechanical trauma is the major prevailing notion for the etiology of work-related back injury, which has been uncovered by other research in this area. The author cites several studies that found that correlates cigarette smoking to low back pain.

1200 female recruits attending basic training at Recruit Training Command were to be examined. The investigators classified back injuries into three categories: nonspecific acute low back pain, acute low back pain with sciatica, and low back pain due to major trauma. This classification was based on the information obtained from the medical record and/or back injury self-report questionnaire that each subject completed. A sample questionnaire was included in the appendix section of the report [page 19].

Unfortunately, the study was not complete as of the date of the report, so no additional information was provided in this document.

**[41] Title: The Health Status of the United States Army: Findings from the Total Army Injury and Health Outcomes Database (TAIHOD)**

**Principal Investigator:** Pfizer Global Pharmaceuticals

**Source:** Pfizer Facts

**Summary/Abstract:** This document describes the prevalence of diagnosed chronic conditions, behavioral risk factors, and healthcare resource utilization among all active-duty service members of the US Army aged 17 to 65 years, serving throughout the world, from 1995 through 2000. The goal is to increase understanding of health issues within this population and promote discussion of healthcare resources rendered to Army personnel.

According to the article, the United States (US) Army represents one of the largest single employers in the United States. Eighty-five percent of active-duty personnel are men, and 92% of service members are younger than 40. Musculoskeletal conditions, and to a lesser degree mental disorders, are the most prevalent diagnosed conditions among US Army personnel. Fifteen percent of Army service members have joint disorders, and 5% of servicewomen aged 40 to 65 years have osteoarthritis. Adjustment reaction affects 4% of active-duty women and 2% of active-duty men, and this condition was the most frequent hospital discharge diagnosis in 1999, accounting for 6% of all hospital stays. Cardiovascular disease prevalence increases with advancing age of Army personnel.

Diagnosed hypertension affects 8% of servicewomen aged 40 to 65 years and 7% of servicemen in this age group.

The document provides statistics that could be used to support evidence found in trends within the United States Air Force. Several charts have been included herein:

- Diagnosed Prevalence of Chronic Conditions Among US Army Personnel.

Table B-4. Ranked prevalent diagnosed conditions among US Army personnel.

### Ranked Prevalent Diagnosed Conditions

Ranked Prevalent Diagnosed Conditions Among US Army Personnel

Rank	Condition	Prevalence (%)
1	Joint disorders	15
2	Internal derangement of knee	2
3	Adjustment reaction	2
4	Hypertension	2
5	Chronic obstructive pulmonary disease (excludes asthma)	2
6	Joint derangement	2
7	Osteoarthritis	1
8	Neuroses	1
9	Depression	1
10	Alcohol dependence syndrome	1

Source: IPDS\* and SADR\*, 1999.

Medical conditions

Psychiatric conditions

\* IPDS = Individual Patient Data System, a component of the TARMOD. IPDS is also known as Standard Inpatient Data

### Mental Disorders

Diagnosed Prevalence of Mental Disorders Among US Army Personnel by Age and Gender

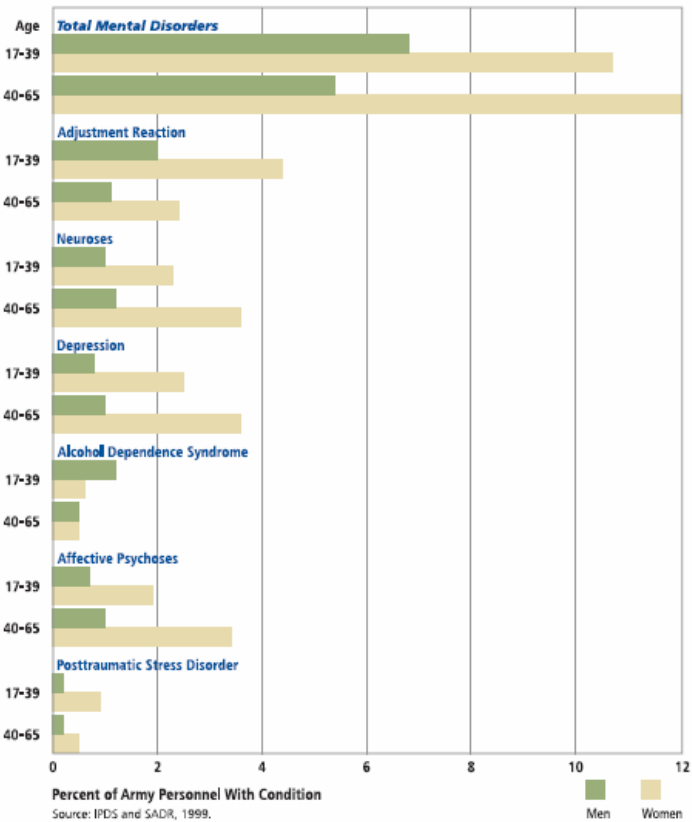


Figure B-1. Diagnosed prevalence of mental disorders among US Army personnel by age and gender.



Cardiovascular rates among active duty members is also discussed. The diagnosed prevalence of total heart disease among active-duty Army personnel is low, 3%, but it increases with age. Heart disease is about five times more prevalent among older servicemen and servicewomen (9% and 10%, respectively), than among younger servicemen and servicewomen (2% each). Additionally, conditions are detailed by gender and ethnicity. The document also reported the prevalence of Behavioral Risk Factors Among US Army Personnel, which included obesity, alcohol, smoking, and low exercise.

**[42] Title: Physical Tasks of Military Occupational Specialties as Risk Factors for Knee-Related Disability Discharge**

**Authors:** Williams, R.E., Amoroso, P.

**Source:** Technical Report, February 2000

**Summary/Abstract:** The report examines the relationship between physical demands of military occupations and disabling knee injury among men and women in the U.S. Army. The goal of the report is to group military occupational specialties (MOS's) into a classification system that describes the physical demands of the job.

The study population was 7,454 cases and controls selected from the TAIHOD system. MOS's were grouped into 11 categories: physical demand rating, maximum weight lifted, maximum distance run/walked, maximum time walked, lift and carry, kneeling, climbing, pushing/pulling, sitting, standing, and career management field; and stratified by gender, race, and age. For the study, a total of 7,454 individuals were sampled between 1980-1994, representing 1,005 cases and 3,009 controls among males and 860 cases and 2,580 controls among women. Two separate logistic regression models were developed and analyzed for this study.

Results [page 26-45] showed that several of the physical task groupings had meaningful trends and associations with disabling knee discharge-maximum weight lifted, pushing/pulling, kneeling, sitting and standing. Racial differences were also found in both genders. Both non-white women and men had reduced odds of discharge for knee-related disability compared to white individuals. Implications of this research is that ethnicity due to physiological differences, has an impact on physically demanding tasks.

**[43] Title: Knee-Related Injuries and Disabilities in the U.S Army 1980-1997**

**Authors:** Sulsky, S., Mundt, K.A.

**Source:** USARIEM Technical Report, August 2000

**Summary/Abstract:** The purpose of this report was to identify predictors of occupational knee injury and knee-related disability. Through the use of case-controlled studies on data obtained from the TAIHOD system, the authors were able to identify differences in the determinants of disability outcomes for active duty members. Initially, the authors performed a preliminary analysis of the data from the system to examine the sociodemographic determinants of discharge from the Army for any knee-related disability. What they found from this study was that the risk of discharge depended on gender, race, and age; and that white women were at higher risk for injury than men and non-white women. Figures B-2 and B-3 provide a graphical representation of the data.

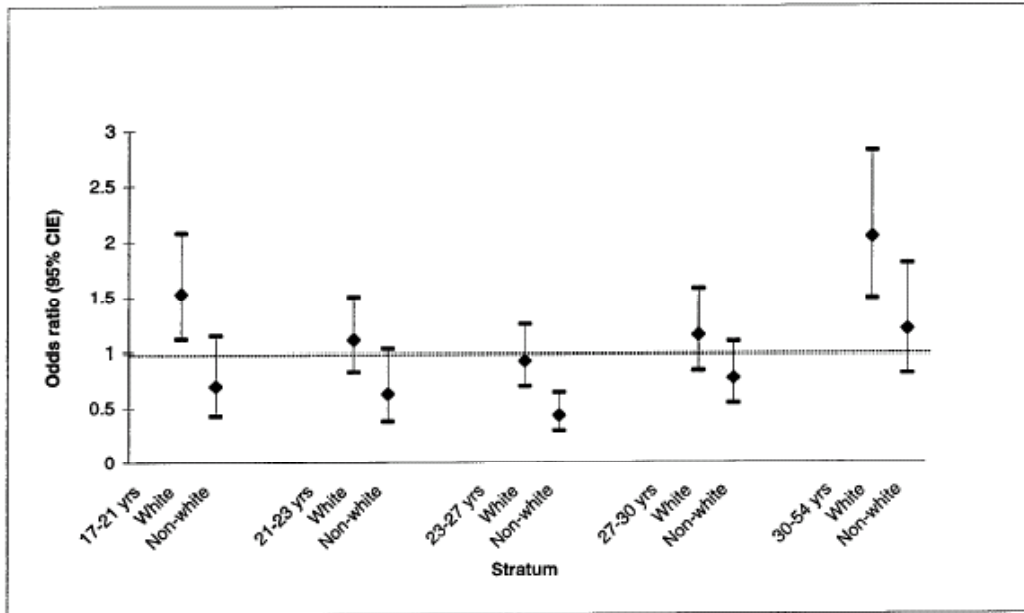


Figure B-2. Relative odds of discharge for disabling knee injury among enlisted women compared to men, stratified by age (quintiles) and race.

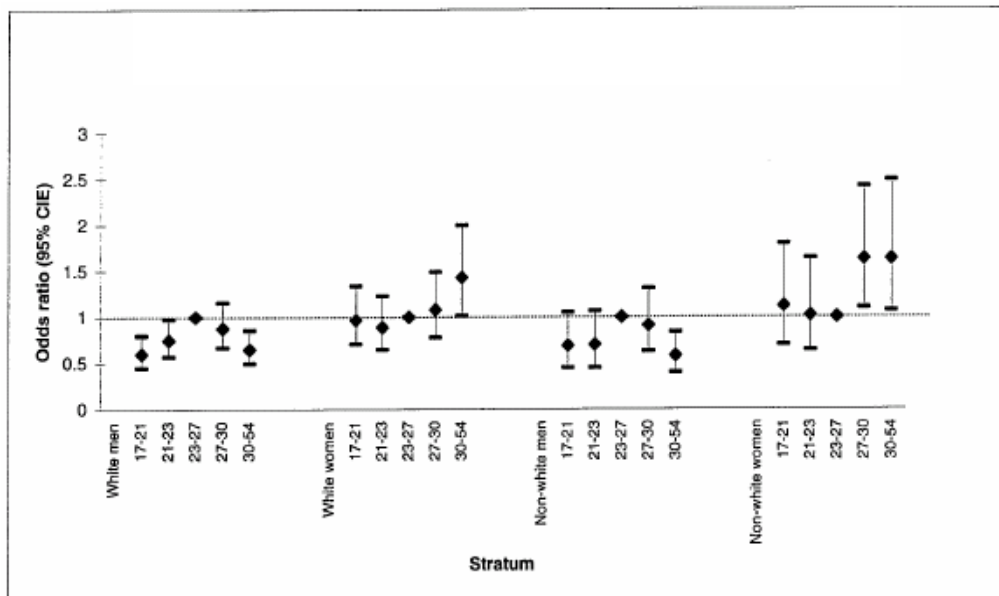


Figure B-3. Relative odds of discharge for disabling knee injury with increasing age, stratified by sex and race.

The authors examined a random sample of incidences of knee injury over 6-month intervals between January 1, 1984 and December 31, 1994. They used codes- based on the VA's System for Rating Disability (VASRD)- that related to any type of knee injury [page 10] to extract the information of all discharged personnel with any knee related

disability who were on active duty at time of discharge, of enlisted rank, and were not missing data for gender. There were a total of 2,106 women and 3,001 men studied [page 16].

Results of the study showed that non-whites were at approximately 30% lower risk than whites for both outcomes. They found that the risk of both injury and disability increased with age for women, and for disability among men. Additionally, length of service, and pay grade was found to affect outcomes for men and women. [19-31]

**[44] Title: Disability from Injuries at Work: The Effects on Earnings and Employment.**

**Authors:** Reville, Robert, Schoeni, Robert.

**Source:** Rand Labor and Population Program, Report, May 2001

**Summary/Abstract:** The objective of this study was to estimate the employment and earning losses associated with workplace injuries, with a focus on injuries with the most lasting economic consequences permanent partial disability, (PPD). Authors used unique administrative data from the state of California to match injured workers to their co-workers with similar pre-injury earnings. Disability claims from 1989-1995 were examined for this study. The estimate of earning loss is the difference in earnings of injured workers and their co-workers before injury, minus the difference after injury, where by design there is no difference in earnings between the injured workers and their co-workers prior to injury. A regression framework was used to estimate earning loss to examine how the path of earnings losses varied across several groups. For the model, the dependant variable was the difference between earnings of the injured worker and the average earnings of their matches [page 10].

According to authors, in 1993, workers' compensation accounted for 2.1 percent of employee compensation nationally. In California, benefits paid to claims for permanent partial disability alone cost approximately \$5 billion per year. Injured workers receive three primary forms of assistance: indemnity benefits, medical benefits, and vocational rehabilitation benefits. A worker who is temporarily able to work only part time or at a reduced wage will receive temporary partial disability. A worker whose injury permanently prevents them from working will receive permanent total disability benefits.

The results of their analysis showed that a large share of the earnings loss was due to lower employment after injury among injured workers. For workers with the least severe injuries [Figure 2, page 33; table 2-4, pages 39-41], the quarterly earnings loss had declined to \$876 by 16 quarters after injury. As expected, workers with more severe injuries had larger earning losses, with earning drop of \$2466 more than workers with the least severe injuries. After 8 quarters, the loss for these workers is \$3,377, which is three times as great as the loss for the least severely injured workers. The analysis also provided significant differences in losses across industries. The largest losses were observed for workers in the highly physical and unionized industries of mining and construction, whose losses after 8 quarters of injuries were \$2,542. Other industries such as durable manufacturing, transportation, communications, electric, gas, and sanitary services have relatively large earnings losses.

In examining earning loss by injury type, it was discovered that employment and earning losses were associated with each of four types of injury (lower back, carpal tunnel, psychiatric and mental stress, and spinal cord) were more severe than the losses associated with the average of all other injuries. Over 5 years after injury, workers with back injuries suffered earning losses that were roughly 18% higher than the losses experienced by workers with other injuries (\$38, 950 versus \$33,027). [table 6, page 42]

**[45] Title: Disability related to the musculoskeletal system: Physical Evaluation Board data**

**Authors:** Amoroso, P.J., Canham, M.L.

**Source:** Chapter 4 of Atlas of Injuries in the US Armed Forces, January 1999

**Summary/Abstract:** This paper reports disability rates, case distributions and costs of disabilities for the Army, Navy/Marines, and Air Force. The paper has arranged data for each military branch separately. Data collected on the USAF begins on page 47, Table 4-7; and shows that between 1990 and 1994, Air Force disability cases increased 80% to 9/1000 personnel/year. As expected, musculoskeletal conditions were the leading cause of disability for all 3 services, for the Air Force the rate was 22% in 1994. Mental disorders were the second leading cause of disability; in 1994 the Air Force rate was 21%. The following chart shows the distribution of the top 15 disability types for the Air Force [page 52]

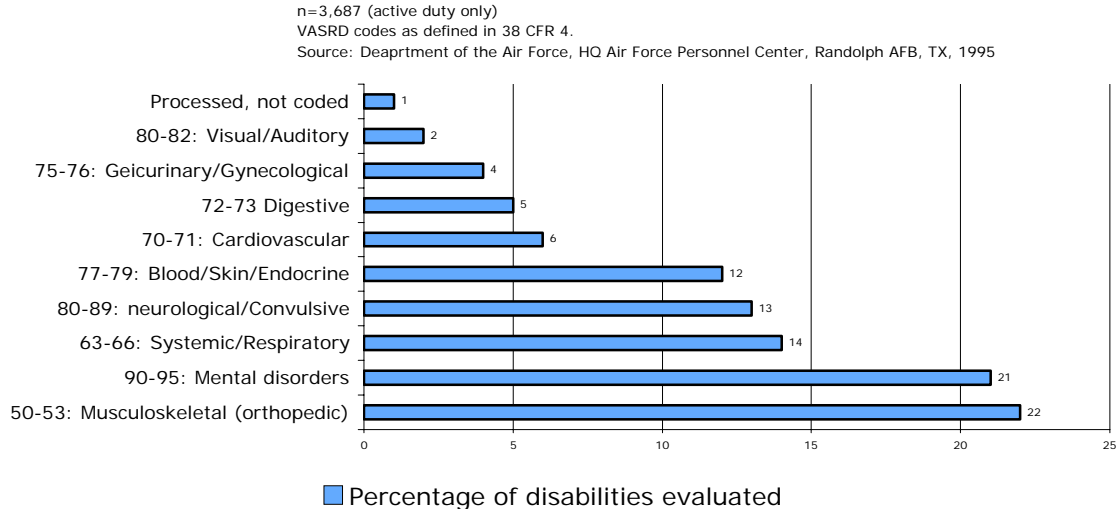


Figure B-4: Distribution of disability by two-digit VASRD Codes, FY 1994.

Between 1993 and 1994, the distribution of PEB disability claim dispositions for active duty Air Force personnel were shown in Table B-5.

Table B-5. Distribution of PEB disability claim dispositions for active duty Air Force personnel between 1993 and 1994.

1993 PEB disability claims (2, 940)	1994 (3,687) PEB disability claims
Temporary disability-36%	Temporary disability-23%
Fit for duty-28%	Fit for duty-41%
Separation with severance pay-25%	Separation with severance pay-19%
Permanent Disability-9%	Permanent Disability-15%
Separation with no benefits-2%	Separation with no benefits-2%

Most cases received separation with severance pay, a one time cost to the services. Individuals with permanent disabilities are compensated for life; individuals with temporary disabilities were compensated for a maximum of 5 years, though most receive permanent disability retirements. Disability compensation costs paid directly by the services represent only about 10% of all such payments. Although, no statistics were provided from the USAF regarding cost of disabilities, the authors point out the distribution of projected lifetime costs by disability disposition in 1993 for the US Army, who estimated the cost of its disability cases during this year to be \$485 million, were:

- Permanent disability-84%
- Separation with severance pay-12%
- Temporary disability-4%

Most disabled service members are compensated by the VA and are not included in the following chart, which illustrates the trends of combined disability compensation costs paid by the military departments from 1980-1990. [page 65]

Table B-6. DoD rates of combining disability compensation costs by fiscal year.

Compensation costs	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
Permanent disability (\$)	1,137	1,249	1,303	1,331	1,327	1,335	1,313	1,296	1,312	1,335	1,373
Temporary disability (\$)	59.1	55.7	53.3	51.4	54.8	51.1	68.6	75.9	86.0	90.9	91.6
Severance pay (\$)	17.9	16.4	20.0	23.4	36.0	49.4	55.1	70.7	93.2	98.6	85.2
Total	1,214	1,321	1,376	1,405	1,417	1,445	1,436	1,442	1,491	1,524	1,549

In 1994, there were a total of 2,221, 547 disability cases, which cost the VA \$1.02 billion per month, which amounted to \$443 per case per month. These costs were in addition to the individual service-related costs. [pages 68-69]. The following chart summarizes the VA disability case and compensation data for December 1994, which provides a snapshot of what yearly disability costs, have been.

Table B-7. Summary of VA disability case and compensation data by VASRD codes, December 1994.

Disability by VASRD codes	Total disability compensation costs/month			Conclusions
	%	Million \$	Average cost/case	
50-53: Musculoskeletal (Orthopedic)	34	346.8	322	Musculoskeletal (Orthopedic) <ul style="list-style-type: none"> <li>• Musculoskeletal (orthopedic) conditions accounted for a third of disability costs in December 1994.</li> </ul> Mental disorders <ul style="list-style-type: none"> <li>• Mental disorders accounted for a quarter of disability costs in December 1994.</li> <li>• Mental disorders and neurological/convulsive conditions accounted for the highest costs per case.</li> </ul>
90-95: Mental disorders	26	265.2	794	
80-89: Neurological/Convulsive	10	102.0	741	
70-71: Cardiovascular	8	81.6	424	
60-62: Visual/Auditory	6	61.2	353	
63-68: Systemic/Respiratory	5	51.0	352	
77-79: Blood/Skin/Endocrine	5	51.0	259	
72-72: Digestive	4	40.8	305	
75-76: Genitourinary/Gynecological	2	20.4	431	

**[46] Title: Disability evaluation system and temporary limited duty assignment process: A Qualitative Review**

**Authors:** Keenan, M. Debra, Wilkins, Gail M.

**Source:** Thesis, Naval Postgraduate School, March 1998.

**Summary/Abstract:** The objective of this thesis was to analyze the factors that contribute to the amount of time a Naval service member spends in a transient and limited duty status for medical reasons. Descriptive statistical data for this study was obtained from several sources. The majority of the primary source data on the active duty enlisted transient and limited duty population was from the Navy's Readiness Information System (ARIS) and Enlisted Assignment Information System (EAIS).

Results of the study [page 61] found no conclusive reason to explain why the percentage of limited duty and acc 335 personnel had not decreased relative to the enlisted population force downsizing. The amount increased from May 1991 through May 1994 but decreased since that time. Changes made to the procedures for processing a medical board or processing a PEB case were unlikely to significantly reduce the costs associated with (accounting category code) ACC 355. Further, delays in the process were identified for members who were assigned to a limited duty status or returning to duty from said status. The author makes recommendations for streamlining the medical board process to assign temporary limited duty or PEB referral [page 179-].

**[47] Title: DoD Statistical Report on the Military Retirement System**

**Authors:** Office of the Actuary, 2001

**Summary/Abstract:** This report provides statistics on retired military personnel by year, from 1900-2001. The document includes data on funds for retired pay in 2001 for each branch of the services; retiree data for military personnel receiving and not receiving retired pay; active duty salary data; and beneficiary data. The data for this report were obtained from files submitted to the Defense Manpower Data Center under RCS DD-P&R (M) 1375.

A disabled military member is eligible for disability retired pay if the member has at least 20 years of service, or the disability is at least 30 percent and either (1)the member has eight years of service; (2)the disability results from active duty; or (3)the disability occurred in the line of duty during a time of war or emergency national or certain other time periods. Members whose disabilities may not be permanent are placed on a temporary disability retired list and receive disability retirement pay just as if they were permanently; however they must be physically examined every 18 months for any change in disability, and a final determination must be made within five years. According to authors, in 2001, 98,000 disability retirees were paid \$1.30 billion. [page 2] For active duty members who die on active duty with over 20 years of service are assumed to have retired on the day they died and to have elected full survivor benefit payment coverage for spouses and/or children.

For the United State Air Force, the number of *temporary disability claims* received for regular officers, non-regular officers, regular enlisted, and non-regular enlisted were 525 (total), 50, 46, 401, and 28 respectively. Dollars expended in 2001 for this type of disability were 498,000 (total); 101,000; 72,000; 300,000; and 25,000. *Permanent disability claims* were 23, 529 (total); 3,506; 4, 543; 15,125; and 355. Expenditures were 31,825,000 (total); 11,046,000; 8,174,000; 12,362,000; and 243, 000. *Temporary and permanent disabled* officers and enlisted claims were 24, 054 (total); 8,145 and 15,909. Expenditures for that year were 32,323,000 (total); 14,393,000; 12,930,000 [page 17]. The number of military retirees receiving retired pay from the DoD for the USAF is illustrated in the following table:

Table B-8. Number of military retirees receiving retired pay from the DoD for the USAF.

<b>Year</b>	<b>Officer</b>	<b>Enlisted</b>
1990	157,384	381,239
1991	159,815	389,033
1992	162,517	397,371
1993	164,882	403,182
1994	166,532	406,957
1995	167,521	414,352
1996	167,866	419,070
1997	168,534	425,152
1998	169,056	431,313
1999	169,499	435,614
2000	169,401	438,753
2001	169,082	442,633

From the chart [page 211] it can be said that more male Air Force service men than women, received retirement compensation for all categories listed.

**[48] Title: Evaluation Report-Accidental Off-Duty Deaths in DoD**

**Authors:** Office of the Inspector General Department of Defense, 1998.

**Summary/Abstract:** The purpose of the evaluation was to determine whether DoD safety programs were effective in reducing off-duty noncombatant deaths. The study focused on 4,698 accidental deaths that occurred during off duty hours from 1988 through 1996. The effectiveness of safety programs was assessed by analyzing the overall off-duty accidental death rates over time and by comparing the motor vehicle death rates and civilian deaths from 1988 to 1996, for ages 17 to 40. Statistics regarding death rates were obtained from computer based information systems from three databases at the Services safety centers, as well as the Office of the Secretary of Defense. The report did not provide the distribution of the sample size among civilian and military populations. A paired t-test was used to compare the two samples.

Table B-9. DoD military personnel deaths.

Total Deaths		30,469
Less: Hostile and terrorist deaths		558
Total nonhostile and nonterrorist deaths		29,911
Less: deaths other than accidents		
Homicide	1,693	
Illness	5,497	
Suicide	4,090	
Undetermined	452	11,732
Total accidental deaths (FY 1980 through 1996)		18,179
Accidental deaths – FY 1980 through FY 1987		11,216
Accidental deaths – FY 1988 through FY 1996		6,693

The results of the analysis showed that accidental off-duty deaths declined from 37 deaths per 100,000 individuals in 1988 to 25.6 deaths (31%) per 100,000 individuals in 1996. At the same time, there was a 52% reduction in the number of total off-duty accidental deaths. Service safety awareness programs and other initiatives were factors that contributed to the reduced accidental death rate. The results showed that motor vehicle accidents accounted for 3,788 of the 4,698 (81%) accidental off-duty deaths from 1988 through 1996. [page 7] Motor vehicle deaths included drivers and passengers and anyone killed by a motor vehicle. Sports-related and recreational related accidents were the second leading cause of death and accounted for 9% of the 4,698 deaths. Accidental off-duty motor vehicle deaths declined per 100,000 individuals in 1996. According to the report, motor vehicle deaths were less for DoD than for the rest of the United States-illustrated by the figure below [page 10].



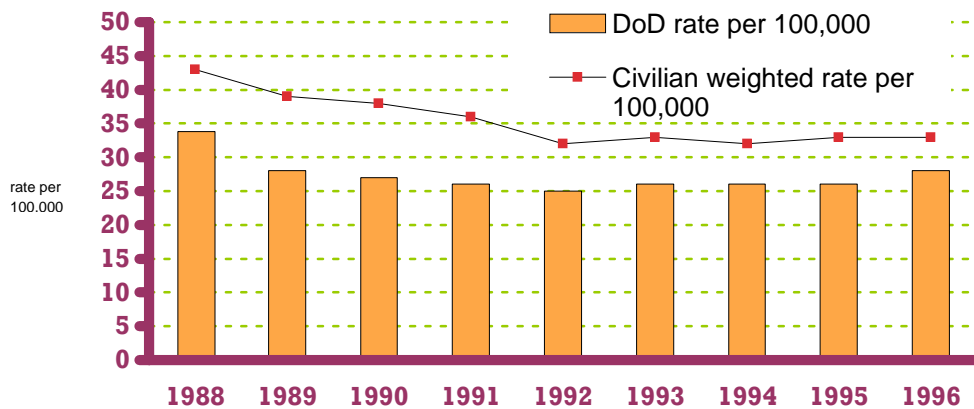


Figure B-5. Motor vehicle related deaths for DoD and the rest of the US.

Toward the end of the report, authors discussed a number of safety programs within the services, which have contributed to the “significant” decline in off-duty DoD deaths.

**[49] Title: Injury Prevention in the US Army, A Key Component of Transformation**

**Authors:** Lt. Colonel Terry Walters

**Source:** Strategy Research Project, US Army War College Office of the Inspector General Department of Defense, 2002.

**Summary/Abstract:** The purpose of this research project was to prove via literature review and survey that an automated injury surveillance system that provided simple unit injury rates to unit commanders would increase injury awareness and would increase use of existing injury prevention resources.

Over a two year period from 1999 to 2001, Walters developed recommendations for an improved automated injury surveillance program, by querying the data warehouse for the current system-Ambulatory Data System (ADS) at a major divisional post. The results of the analysis showed that the overall average annual rate of injuries within the Army was 27%, which was similar to injury rates reported in other studies; and that injury rates remained high even when the rates were analyzed by gender. 36.3% for females and 29.1% for males. See Figure B-6.

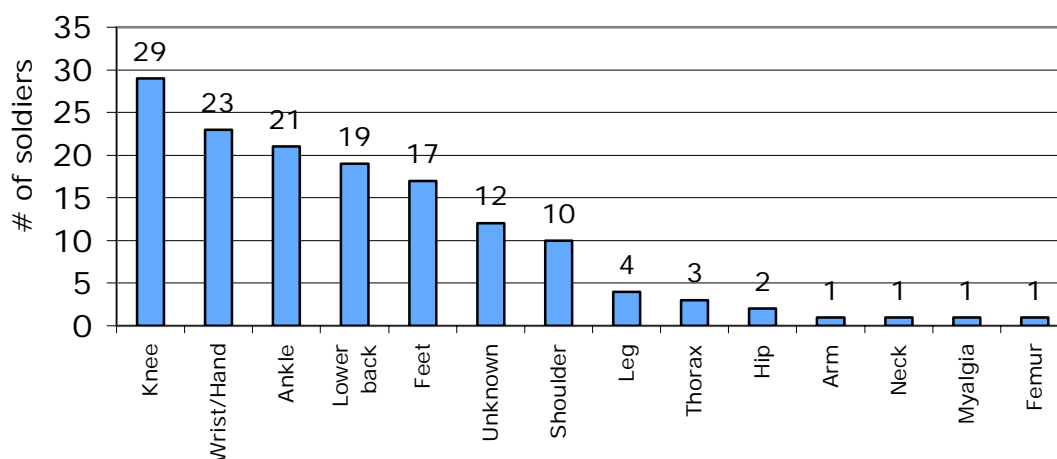


Figure B-6. Location of injuries in an infantry battalion. IN Bn location of injuries # of injured soldiers = 144, N=500 in IN BN, 28.8% annual incidence FY 00.

The results of this experiment combined with a survey of Army War College students to examine leaders' attitudes concerning injuries, explicate some of the institutional barriers affecting injury prevention in the US Army.

**[50] Title: Method & Actions for Improving Performance of the Department of Defense Disability Evaluation System**

**Authors:** Marcum, Cheryl, Emmerichs, Robert.

**Source:** Rand National Defense Research Institute, Report, 2002.

**Summary/Abstract:** The purpose of this report is to examine how training DES primary participants could help provide more consistent disability evaluation results for similarly situated members of the military services. This report provides background information on the disability evaluation system (Chapter 2 & 3); issues and interventions for achieving consistent policy application (Chapter 4); and documents the requested DES training analysis and recommended changes in training along with other recommendations to improve system performance.

The issues and/or discrepancies that were found among the specific military branches were discovered during the associated PEB evaluations of disability claims; and included the job titles for the PEB administrative action officer and composition of the informal PEB board; in determining fitness levels of members [page 30]; number of days for PEB to make a decision; number of people who review informal PEB findings and recommendations; the manner in which proceedings are handled. A *goal fabric analysis*, a bottom-up planning tool for identifying actions needed to address a diverse set of issues and organizing those actions into an overall plan was utilized [page 44]. This tool provided researchers with a context within which to identify issues and necessary actions, and then design a comprehensive plan around those actions.

**[51] Title: Hospitalizations due to injury: Inpatient medical records data**

**Authors: Gardner, J.W., Amoroso, P.J.**

**Source: Chapter 5 of Atlas of Injuries in the US Armed Forces, January 1999.**

**Summary/Abstract:** This paper summarizes hospitalization rates and trends, injury hospitalizations relative to other diagnosis, and injury hospitalizations by external cause of injury. The chapter provides a description of the hospitalization admission databases used in the armed forces; and provides hospitalization data, which includes injuries and other causes of hospitalization for each branch of the military.

Between 1980 and 1994, the Air Force hospitalization rate declined 35% to 100/1,000 personnel/year. [page 5-95]. Musculoskeletal conditions, were frequently the result of injuries, and the leading cause of hospitalizations for all branches except the Air Force. Digestive conditions accounted for the largest proportion of hospitalizations in the Air Force in 1994. [page 5-96]. The chart below summarizes the Air Force hospitalization distribution data by diagnosis. For nonmedical causes of injury; athletics/sports were the leading cause of injury hospitalization for the Air Force in that year.

**[52] Title: Gender differences in musculoskeletal injury rates: a function of symptom reporting?**

**AUTHORS:** Sandra Almedia, Sandra A.; Trone, Daniel W.; Leone, Denise M. ; Shaffer, Richard A.

**SOURCE:** Medicine and Science in Sports and Exercise 31 no12 1807-12 D 1999

**Summary/Abstract:** The purpose of this investigation was to determine whether gender differences in the likelihood of reporting musculoskeletal injury were apparent among USMC recruits, and, if so, whether these reporting differences contributed to the higher rates of injury found among female trainees.

According to the authors, most studies of collegiate athletes and recreational runners have shown no difference in injury rates between the sexes, a number of investigations in military training populations have shown that women are at increased risk of musculoskeletal injuries relative to men. As other sources have shown, for certain specific diagnoses, such as stress fractures, rates among female military trainees have been cited to be up to 12 times higher than rates among male trainees. Numerous factors have been considered, although not well studied, as possible etiologies for the increased injury rates reported in military women. These factors include, women's poorer baseline fitness levels, gender differences in musculoskeletal anatomy, characteristics of military training, and footwear. Also, it has been well documented in both military and civilian populations that women use health care services at higher rates than men. However, gender differences in symptom reporting have not been studied as a possible explanation for the increased musculoskeletal injuries found among women military trainees.

This investigation was a substudy within two larger studies, conducted at Marine Corps Recruit Depot (MCRD) San Diego and MCRD Parris Island, of musculoskeletal injuries in USMC recruits. Male subjects (N = 176) were a subset of 513 randomly selected male USMC recruits who reported to MCRD San Diego for boot camp training between October 5, 1993, and April 20, 1994. Female subjects (N = 241) were a subset of all 400

female USMC recruits who reported to MCRD Parris Island for boot camp training between January 29 and March 25, 1996 (platoons 4012 to 4019). Reported injuries were measured by medical record reviews. Unreported injuries were determined by a questionnaire and a medical examination administered at the completion of training.

The results of the study showed that for men and women subjects, the majority of reported and unreported diagnoses were overuse injuries, distributed from the knee downward. Although the most common reported and unreported injuries were similar between genders, there were also some striking differences. Among female recruits the most commonly reported injuries were patellofemoral syndrome (10.0% of subjects), ankle sprain (9.1%), and iliotibial band syndrome (5.8%); the most common unreported injuries were patellofemoral syndrome (2.1%), metatarsalgia (1.7%), and unspecified knee pain (1.7%). Among male recruits iliotibial band syndrome (4.0% of subjects), ankle sprain (2.8%), and Achilles tendinitis/bursitis (2.8%) were the most frequently reported injuries; shin splints (4.6%), iliotibial band syndrome (4.0%), and ankle sprain (2.8%) were the most common unreported diagnoses.

Female recruits were more likely to have a reported injury than male recruits (44.0% vs 25.6%), but they were less likely to have an unreported injury (11.6% vs 23.9%). When both reported and unreported injuries were measured, total injury rates were high for both sexes (53.5% women, 45.5% men). The results of the study indicate that the higher injury rates often found in female military trainees may be explained by gender differences in symptom reporting.

**[53] Title: Disposition Decisions in U.S. Air Force Basic Trainees Assessed During Mental Health Evaluations**

**Authors:** Mark A. Staal, Jeff A. Cigrang, Edna Fiedler

**Source:** Military Psychology, 2000, 12(3), 187–203

**Summary/Abstract:** The purpose of this study was to develop empirically derived profiles of the 4 trainee disposition groups that distinguished trainees: (1) needing hospitalization due to emotional instability; (2) those requiring immediate separation from the Air Force but did not need hospitalization; (3) those who required administrative separation from the Air Force, but did not necessitate immediate care or removal; (4) and those who are returned to duty.

According to authors, a small but significant percentage of people entering the U.S. Air Force are evaluated during Basic Military Training for mental-health-related issues. These trainees are referred for mental health evaluation for various reasons related to their adjustment to the training environment or past history. The 6-week Basic Military Training (BMT) course at Lackland Air Force Base, TX is both mentally and physically challenging. Although the vast majority of trainees adapt to the stressors of BMT, a minority (approximately 5%) exhibits psychological reactions that lead to a formal mental health evaluation by a clinical psychologist. When the expressed psychological reactions are noted by the trainee's command or a treating medical provider, the result is often a mandatory referral for evaluation. However, voluntary evaluations are commonly initiated through self-referral, the chaplain's office, or both.

The participants selected for this study were basic trainees (1,048) assessed at the BAS during a 6-month period. The data used for the analysis was collected from information routinely obtained during the standard evaluation process for basic trainees at the BAS: data from psychological testing, specifically the Minnesota Multiphasic Personality Inventory, self-report questionnaires, and clinical interview notes. Data from the evaluation process were analyzed by discriminant analysis. The categorical outcome measures used by discriminant analysis were used by the authors as the recommended disposition status: RTD, administrative separation, immediate separation, or hospitalization.

The findings of this investigation indicate that several key variables exist in the Air Force basic trainee's profile that may be used by the psychologists for disposition Classification: diagnosis, suicidal intent (self-reporting plans to suicide), a history of physical or sexual abuse (or both), self-reported current impact of that abuse (physical, sexual, or both), past alcohol treatment. (Table 3, page 193). Revealing that these variables differentially predicted the four group dispositions. Further implications of this research are that the administrative separation group may best be labeled the "depression group" when compared to the other three groups, given such a high rate of the diagnosis. The results showed that collectively, 70% of these trainees met the criteria for one of the following diagnoses: PTSD, depression, or adjustment disorder (see Table 1). In addition to diagnosis, a self-reported history of sexual abuse was also significantly predictive of the administrative separation group.

**[54] A \$22 billion plan to aid veterans; Legislation attacks century-old limits on disability and retirement pay.(NEWS)." *The Star-Ledger (Newark, NJ)* (Oct 17, 2003): 006. Byline: ROBERT COHEN. *Custom Newspapers*. Thomson Gale Database. Document Number: CJ10898729. North Carolina A&T State University. 14 March 2006.**

**Summary/Abstract:** In 2003, lawmakers yesterday announced an agreement to make more veterans eligible for disability benefits and full military retirement pay. The new plan, expected to be included in the defense appropriations bill later this year, would allow retirees who are considered at least 50 percent disabled by Department of Veterans Affairs guidelines to start receiving disability and retirement pay.

The provision would be phased in over a decade at a cost of \$22 billion. Members of the National Guard and reserve units also would be in line for more generous compensation. The plan will help some 245,000 disabled military retirees, nearly half of those who now lose a dollar in retirement pay from the Pentagon for each dollar they receive in disability compensation from the Department of Veterans Affairs. Under the compromise, veterans with a service-connected disability rated 50 percent or higher by the Veterans Affairs Department would get their full retirement pay after 10 years.

VA disability rates run from a tax-free \$633 a month for those with a 50 percent disability to \$2,193 for someone with 100 percent disability. Under the phase-in, the 50 percent disabled person would get \$100 a month effective Jan. 1, 2004, and the totally

disabled person \$750 toward his or her lost retirement pay. Additionally, Purple Heart veterans and others with combat-related disabilities would get full benefits.

**[55] Title: The Association between In-Service Sexual Harassment and Post-Traumatic Stress Disorder among Department of Veterans Affairs Disability Applicants.**

**Authors:** Maureen Murdoch, Melissa A. Polusny, James Hodges, Diane Cowper

**Source:** Military Medicine, 171, 2:166. 2006

**Summary/Abstract:** The goal was to describe the association between post-traumatic stress disorder (PTSD) and in-service sexual harassment in a nationally representative sample of Department of Veterans Affairs PTSD disability applicants. According to authors, PTSD affects 7% to 12% of U.S. adults. In contrast, 30% of Vietnam combat veterans and 50% to 60% of former prisoners of war have been diagnosed as having PTSD. Among rape victims, the lifetime prevalence ranges from 30% to 65%. PTSD is the most common psychiatric condition for which veterans seek VA disability benefits. Since 1980, >200,000 male and female veterans have sought VA disability benefits for PTSD, and each year the VA treats or compensates almost 600,000 veterans with this condition. [166]

As defined by criterion A for PTSD in the Diagnostic and Statistical Manual of Mental Disorders. Fourth Edition (DSMIV), trauma leading to PTSD must involve "actual or threatened death or serious injury, or threat(s) to the physical integrity of one's self or others" and must prompt "intense fear, helplessness, or horror." Sexual assault, a widely recognized risk factor for PTSD, is a prototypical criterion A stressor. Although approximately one-half of women in the general population have been affected by sexual harassment at some point during their employment almost 80% of a large representative sample of military women reported sexual harassment within a 1-year period. In most workplaces, including the military, coworkers perpetrate the majority of sexual harassment. The near absence of men in these studies is another limitation. Although women are substantially more likely than men to be sexually harassed, harassment is not uncommon among men. Almost 40% of men in the Armed Forces report being sexually harassed, for example. The only study of men we found measured a modestly positive correlation between sexual harassment and PTSD. [167]

The study was a cross-sectional survey; a 20-page, self-administered questionnaire to a representatively sampled, eligible pool of 2,466 men and 2,452 women who had previously filed VA PTSD disability claims. Surveys were mailed an average of 2 years after recipients had filed their claims, and almost all claims had been decided. Results of the analysis of the data showed that of 4,918 eligible veterans, 3,337 (68%) returned surveys. The effect seen was about the same size as that seen for combat exposure among the men and for in-service sexual assault among the women. Men showed no association between in-service sexual harassment and PTSD. Among female veterans seeking PTSD disability benefits, reported in-service sexual harassment severity and current PTSD symptom severity had a small but statistically significant association. Their findings are consistent with earlier reports linking sexual harassment with PTSD among women. It is also unclear whether sexual harassment produces the same psychobiological state (e.g.,

physiological cue reactivity) as found for PTSD sufferers. The findings in this study could not be generalized because victims' perception of sexual assault could be more traumatic if experienced in another setting outside the military.

**[56] Title: Reducing medical attrition: The role of the accession medical standards analysis and research activity**

Kathryn L Clark; Ramy A Mahmoud; Margot R Krauss; Patrick W Kelley

**Source:** *Military Medicine*; Jul 1999; 164, 7, pg. 485

**Summary/Abstract:** This paper illustrates how aiding an epidemiologic perspective to medical accession policy development allows the DoD to address unacceptably high rates of premature attrition, lost duty time, avoidable medical care cost, sick leave, and so on. The Accession medical Standards Steering Committee was established by the Under Secretary of Defense to integrate the medical and personnel communities, so that they could provide policy guidance and establish standards for accession requirements. The goal for this committee is such that future medical standards will be based on rigorous studies, including careful evaluation of evidence and methodologically appropriate analysis of data; and is called The Accession medical Standards Analysis and Research Activity (AMSARA).

Each of the five services (Army, Navy, Air Force, Marine Corps, and Coast Guard has the ultimate responsibility to determine which individuals will enter that service. The objectives of the screening medical examination are to prevent the entrance of individuals with contagious diseases or conditions that would lead to excessive treatment, hospitalization, or separation and to ensure that individuals are capable of completing training, performing duties, and remaining geographically adaptable. There are more than 300,000 enlisted accessions per year. Approximately 30 to 35% of all enlistees who enter the services separate before completion of the first term of service, and 10 to 15% are actually discharged in the first 6 months of duty. [485] These rates are similar across the services. There are more than 6000 medical discharges annually just for conditions that existed before enlistment. Personnel and Readiness estimated that the cost of recruiting, screening, and training an individual in the basics and initial skills was approximately \$20,000. The authors postulate that there is a clear benefit to setting policies and standards that are supported by the best available evidence and not by selected opinion or historical precedent alone.

Since its inception, AMSARA has enabled the committee to evaluate current databases, which have lead to important findings and future research, which includes findings that individuals older than 25 years old with a college degree are less likely to access. [486].

**[57] Traumatic Deaths During U.S. Armed Forces Basic Training, 1977–2001**

**Authors:** Stephanie L. Scoville, John W. Gardner, Robert N. Potter

**Source:** *Am J Prev Med* 2004;26(3)

**Summary/Abstract:** The purpose of this analysis is to provide an epidemiologic description of traumatic recruit deaths from 1977 through 2001; and an analysis of nontraumatic recruit deaths during the same time period was also performed. Recruit deaths from 1977 through 2001 were identified and confirmed through redundant

sources in support of the Department of Defense Medical Mortality Registry for the Air Force, Navy, Marine Corps, or Army.

Traumatic deaths appear to occur less frequently during basic military training (BMT). Two population based studies showed that 16% of Air Force recruit deaths and 29% of a subset of Navy and Marine Corps recruit deaths were traumatic deaths. There were 276 deaths identified through the Recruit Mortality Registry in 6.3 million recruits over 25 years, who generated 972,000 recruit-years of BMT experience. Age-specific recruit mortality rates were less than half of same-age U.S. civilian mortality rates. Only 28% (77 of 276) of recruit deaths were classified as traumatic (suicide, unintentional injury, and homicide), in comparison to three quarters in both the overall active duty military population and the U.S. civilian population (ages 15–34 years). The age-adjusted traumatic death rates were highest in the Army (four times higher than the Navy and Air Force, and 80% higher than the Marine Corps). The majority (60%) of traumatic deaths was due to suicide, followed by unintentional injuries (35%), and homicide (5%). The overall age-adjusted traumatic mortality rate was more than triple for men compared with women in all military services [pages 196-202]. Based on the results there was a lower proportion of traumatic deaths in recruits compared to the overall active duty military population and same-age U.S. civilian population. This finding could be attributed to close supervision, emphasis on safety, and lack of access to alcohol and motor vehicles during recruit training.

**[58] Stress fractures in Female Army Recruits: Implications of Bone Density, Calcium Intake, and Exercise**

**Authors:** Alana Cline, Richard Jansen, Chrispothor Melby.

**Source:** Journal of American College of Nutrition, Vol 17(2), 128-135 (1998)

**Summary/Abstract:** The objective of this case-control study was to identify characteristics and factors associated with increased risk for stress fractures in military women. 49 female soldiers with confirmed stress fractures (cases) and 78 females soldiers with no orthopedic injuries (controls); aged 18 to 33 years were recruited from a military installation during 12-week basic training.

Prevention of even a small number of injuries would yield large benefits, both monetarily and in troop productivity. The majority of these studies have included only men, but as more women enter the services, several recent studies have included the latter as well. This research has implications that can be applied to the civilian population. Women entering the military have a much higher incidence of stress fracture injury during basic training than men, with approximately 1 to 3% and 10 to 21% of new male and female recruits, respectively being affected. The results of the study show that stress fracture in female Army recruits were not correlated with bone density or calcium intake during adolescence; and that there was a weak relationship observed to prior physical activity.

**[59] The focus on women veterans who use Veterans Administration Health Care: The Veterans Administration Women's Health Project**

**Authors:** Katherine M Skinner; Joan Furey

**Source:** Military Medicine; Nov 1998; 163



**Summary/Abstract:** The effects of military duty on women are largely unknown. This article discusses the history of women in the military and presents findings from the VA Women's Health Project. This project is designed as a national, cross-sectional observational study to describe the health related quality of life of women veterans who use VA ambulatory care.

The study was designed to describe the health-related quality of life of women who receive VA ambulatory care. According to the authors, currently more than 229,000 women are on active duty, and about 19% are officers. Overall, 50% of military jobs are open to women, although the percentage varies by service (Air Force, 97%, Navy, 59%, Army, 52%, Marines 20%). Two samples were taken from the VA Women's Health Project. The first was a randomly selected sample of women vets who had at least one outpatient visit to a VA facility from July 1, 1994 to June 30, 1995. A second sample included women vets who had at one outpatient visit during the same time period to a different facility [762]. Data was collected via a self-administered mailed survey. For the data collected from the surveys, ages ranged from 21 to 93 years; most women were white, almost two-thirds had some college education, and 11% had completed graduate school. 23 % of the women surveyed served in the Air Force; and almost three-quarters (73%) of the sample receive all or most of their health care at VA facilities. Results of the study found that veteran women scored lower on all scales compared to non-veteran women. The figure below illustrates this point.

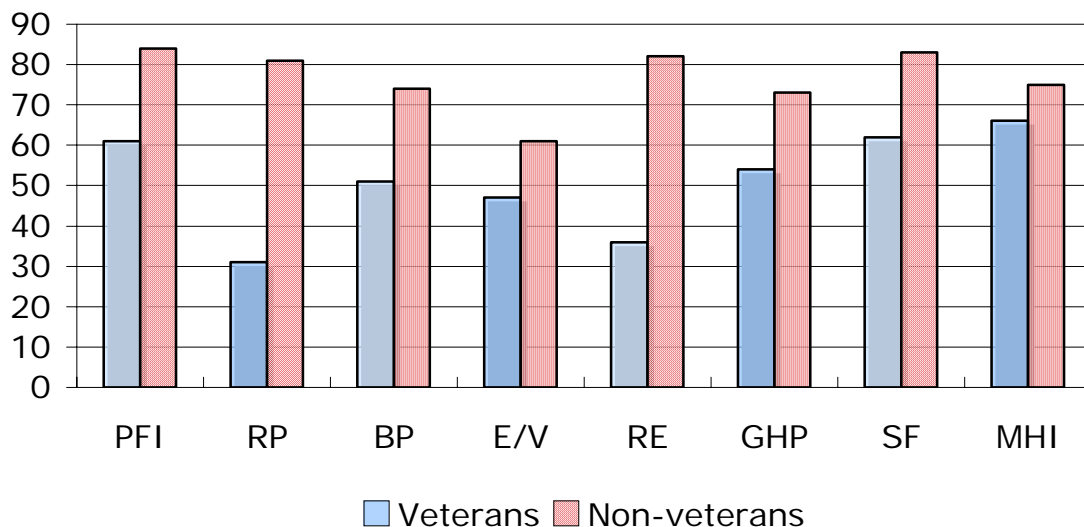


Figure B-7. Unadjusted SF-36 scores for veteran and non-veteran women. PFI, physical functioning; RP, role limitations attributable to physical problems; BP, bodily pain; E/V, energy and vitality; RE, role limitations attributable to emotional problems; GHP, general health perceptions; SF, social functioning; and MHI, mental health.

**[60] Title: Predictors of Low Physical Fitness in a Cohort of Active-Duty U.S. Air Force Members**

**Authors:** Anthony S. Robbins, MD, PhD, Susan Y. Chao, MS, Vincent P. Fonseca, MD, MPH, Michael R. Snedecor, MD, MPH, Joseph J. Knapik, ScD

**Source:** American Journal of Preventative Medicine 2001, 20(2), p. 90–96

**Summary/Abstract:** The purpose of this study was to identify the independent effects of demographic and behavioral factors on risk of failure to meet USAF fitness standards (hereafter called low fitness). According to authors, in the U.S. Air Force (USAF), aerobic physical fitness is assessed using a testing technique called submaximal cycle ergometry to estimate maximal oxygen uptake (VO<sub>2</sub>max), which is administered annually, and published for active-duty Air Force (ADAF) members. In both military and civilian populations, factors related to low physical fitness levels, such as physical activity and obesity, are unevenly distributed across demographic groups. Therefore, it is reasonable to hypothesize that physical fitness levels might also differ across demographic groups [90].

The present study describes the associations between behavioral and demographic characteristics and physical fitness (as measured by submaximal cycle ergometry) in a large cohort of ADAF members who underwent testing in 1998–1999. In order to assess the independent roles of behavioral and demographic factors, authors performed multivariate analyses that adjusted simultaneously for all available factors related to physical fitness. A retrospective cohort study (38,837) was conducted using self-reported health risk assessment data and cycle ergometry data from active-duty Air Force (ADAF) members. The results of the study proved that both demographic and behavioral factors play important roles in physical fitness. Furthermore, demographic groups at increased risk were toward the upper end of the ADAF age distribution, senior enlisted men, and blacks. Overweight/obesity was the behavioral factor with the largest effect among men, with aerobic exercise frequency ranked second.

**[61] Title: Psychiatric Illness and the Workplace: Perspectives for Occupational Medicine in the Military**

**Author:** Steven Pflanz

**Source:** Military Medicine; Jun 1999; 164, 6; pg. 401

**Summary/Abstract:** Little research has been done to examine how the routine military work environment affects the mental health status of military employees. This paper provides a review of the occupational medicine literature on the relationship between the work environment and employee mental health. This review suggests that a comprehensive examination of the relationship between the military work environment and the mental health of military employees is needed. According to authors, it has been recognized that occupational problems are a frequently used diagnosis in military clinics, and this has been attributed to specific characteristics of the military environment [401].

Each year, 15% of every work force will experience at least one episode of psychosocial disability and an additional 10% will suffer from problems related to alcoholism. Studies have found that stress claims represent up to 15% of all occupational disease claims and that stress-related occupational disease claims are increasing rapidly at the same time that

all other disabling work injuries are decreasing. The number of stress claims increased 700% between 1979 and 1988, and the costs per stress claim average approximately \$12,000 per case, twice the average cost for all injury claims [401].

Implications for the military are such that a significant percentage of military personnel suffer from psychiatric illness or emotional distress. This type illness exacts a toll on military readiness through personnel absences from work, poor performance, poor morale, reduced unit cohesion, accidents, and injuries. Financial costs include medical (prescription and hospitalization), retraining costs, etc. Authors suggest that similar tactics used in the civilian sector could be used to minimize stress and mental illness among military personnel [404-405].

Table B-10. Reasons for service separation among active-duty Army enlisted soldiers after first hospitalization in 1998, by discharge diagnosis.

Service separation reason	First Hospitalization		Discharge Diagnosis		Analysis	
	Mental disorder (N=1,763)		Other illness* (N=12,039)		Relative risk of separation	95% CI
	N	%	N	%		
Completion of enlistment/retirement	152	8.6	1,562	13.0	0.66	0.57-0.78
Service-related medical condition determined by disability evaluation	145	8.2	531	4.4	1.86	1.56-2.23
Medical condition that existed prior to service	133	7.5	46	0.4	19.74	14.17-27.50
Personality disorder	194	11.0	24	0.2	55.20	36.23-84.11
Alcohol/drug rehabilitation failure	56	3.2	10	0.1	38.24	19.55-74.81
Misconduct/court martial/discharge in lieu of trial/imprisonment	300	17.0	229	1.9	8.95	7.59-10.55
Unauthorized work absence (absent without leave)	32	1.8	48	0.4	4.55	2.92-7.10
Unsatisfactory performance during entry-level training	81	4.6	64	0.5	8.64	6.25-11.95
Failure to meet physical fitness or weight requirements	27	1.5	81	0.7	2.28	1.48-3.51
Pregnancy/parenthood	23	1.3	634	5.3	0.25	0.16-0.37
Death	4	0.2	26	0.2	1.05	0.37-3.01
Other	27	1.5	163	1.4	1.13	0.76-1.69
Code not available	0	0.0	3	<0.1		
Remained in military service	589	33.4	8,618	71.6		

\* Any of the 15 nonpsychiatric ICD-9-CM illness categories.

The results of this study found that mental disorder hospitalizations were significantly associated with service-related medical disability separations. [588] Overall, only 8% of soldiers hospitalized for mental disorders received a medical separation compared with 4% of those hospitalized for other medical conditions. Also, the level of disability awarded was significantly higher among those with mental disorders compared with persons treated for other conditions. The research further implies that mental disorder is mediated by greater disease chronicity and severity; as well as a variety of behavioral problems including misconduct, legal problems, and alcohol/drug-related problems.

## APPENDIX C Summaries of articles reviewed: its relevancy, statistics measured and findings.

Table C-1. Summaries of articles reviewed: its relevancy, statistics measured, and findings.

Category	Title	Reference		DOE	Statistics Measured	Findings
Compensation & Policy	Title: “DOD DISABILITY: Overview of Compensation Program for Service Members Unfit for Duty”, April 2001.	Authors: Department of Defense	Military Policy-makers	Review	Examined how DOD administers its disability severance pay for service members with less severe disabilities and the associated administrative costs and coordination issues	Provides information & statistics on disability claims [see lit review]
Compensation & Policy	Audit Report: Medical Disability Discharge Procedures, DoD, June 8, 1992.	Authors: Department of Defense	Military Policy-makers	Review	Determine whether military members identified as medically disabled were expeditiously discharged from the services, and to assess the effectiveness of the discharge process and related internal controls.	Authors determined that the DoD disability system was not efficient or economical; disability cases were not processed promptly, and personnel were incorrectly rated for their disabilities, and were paid excessive compensation.
Compensation & Policy	Title: “Long-Term Outcomes of Veterans Discharged with Disabilities from the U.S Army”	Principal Investigators: Steven Wright, Paul Amoroso Source: Annual Report, U.S Army Medical Research & Material Command, October 2001	Military Policy-makers, Military Physicians & Trainers	Review	The purpose of the study was to compare a sample of discharged veterans with a disability from the military between 1985-1999 to those discharged without any disability or hospitalization. Investigators used the Army’s TAIHOD database to obtain subjects for the study.	The study was not complete as of the date of the report, so no additional information was provided in this document.

Compensation & Policy	Title: DoD Statistical Report on the Military Retirement System”	Authors: Office of the Actuary, 2001	Military Policy-makers, Military Physicians & Trainers	Review	Provides statistics on retired military personnel by year, from 1900-2001; includes data on funds for retired pay in 2001 for each branch of the services; retiree data for military personnel receiving and not receiving retired pay; active duty salary data; and beneficiary data.	The number of military retirees receiving retired pay from the DoD for the USAF is illustrated in the following table; from the chart [page 211] it can be said that more male Air Force service men than women, received retirement compensation for all categories listed
Dis.& Policy	Title: “The Health Status of the United States Army: Findings from the Total Army Injury and Health Outcomes Database (TAIHOD)”	Principal Investigator: Pfizer Global PharmaceuticalsSource: Pfizer Facts	Military Policy-makers, Military Physicians & Trainers	Review	Describes the prevalence of diagnosed chronic conditions, behavioral risk factors, and healthcare resource utilization among all active-duty service members of the US Army aged 17 to 65 years, serving throughout the world, from 1995 through 2000.	The document provides statistics that could be used to support evidence found in trends within the United States Air Force.
Dis.& Policy	Title: Disability from Injuries at Work: The Effects on Earnings and Employment.”	Authors: Reville, Robert, Schoeni, Robert. Source: Rand Labor and Population Program, Report, May 2001	Military Policy-makers, Military Physicians & Trainers	Retrospective (Civilian) Study	To estimate the employment and earning losses associated with workplace injuries, with a focus on injuries with the most lasting economic consequences permanent partial disability, (PPD); unique administrative data from the state of California to match injured workers to their co-workers with similar pre-injury earnings.	Showed that a large share of the earnings loss was due to lower employment after injury among injured workers; discovered that employment and earning losses were associated with each of four types of injury (lower back, carpal tunnel, psychiatric and mental stress, and spinal cord

Mental Dis.	Title: Prevalence of Psychotic Comorbidity in Combat-Related Post traumatic Stress Disorder	Authors: Kozaric-Kovacic, Dragica, and Andreja Borovecki Source: Military Medicine, March 2005, 170: 223-226	PEB	Restrospective Study	to explore the prevalence of psychotic symptoms among Croatian war veterans with combat-related PTSD. The study included 680 men who had experienced combat stress and had diagnosed with PTSD confirmed prior.	Survey indicated that approximately 80% of individuals with PTSD meet criteria for at least one psychiatric diagnosis. The most frequent diagnoses are major depressive disorder, other anxiety disorders, substance abuse, somatization, personality disorders, and dissociative disorders.
Mental Dis.	Title: The Occupational Burden of Mental Disorders in the U.S. Military: Psychiatric Hospitalizations, Involuntary Separations, and Disability	Authors: Charles W Hoge; Holly E Toboni; Stephen C Messer; Nicole Bell; et al Source: The American Journal of Psychiatry; Mar 2005; 162, 3; (ProQuest Nursing Journals) pg. 585-591	Military Policy-makers, Military Physicians & Trainers	Case Study	To characterize the risk and reasons for service separation for soldiers hospitalized with mental disorders compared with those hospitalized for other illnesses. Authors followed a cohort of 13,971 U.S Army soldiers first hospitalized in 1998 and followed them for up to 2 years.	The results of the study showed that the rate of service separation 6 months after first hospitalization was 45% among personnel whose primary hospital discharge diagnosis was a mental disorder; 27% among those with secondary mental disorder; and 11% among those hospitalized for all other medical conditions
Mental Dis.	Title: Psychiatric Disabilities in the Federal Workplace: Employment Law Considerations.	Authors: Turner, Miranda W. Source: Air Force Law Review; 2004, Vol. 55, p313, 22p	Physicians & Policy Makers	Review	Examines the Rehabilitation Act as it applies to psychiatric disabilities or disorders	Relevant point which explains that a “civilian Air Force employee may not be required to see an active duty Air Force doctor, or a civilian doctor employed by the Air Force as a civilian employee or contractor,” in order to obtain a diagnosis of mental disability.

Mental Dis.	Psychiatric Illness and the Workplace: Perspectives for Occupational Medicine in the Military	Steven Pflanz Military Medicine; Jun 1999; 164, 6; pg. 401	Military Policy-makers, Military Physicians & Trainers	Review	Provides a review of the occupational medicine literature on the relationship between the work environment and employee mental health.	Suggestions made that similar tactics used in the civilian sector could be used to minimize stress and mental illness among military personnel.
Mental Dis.	Profile of Psychiatric Disorders in the Sri Lanka Air Force and the Outcome at 6 months	Authors: Hemamali, Perara and Thirupathy Suveendran Source: Military Medicine, May 2004, 169: 396-399	PEB	Case Study	To identify the mental health needs of Sri Lanka Air Force (SLAF). 76 military persons were seen as outpatients, all were men between 18 and 50 years of age.	Found that the stress involved in serving in the military promotes the onset of mental illness. Depression and suicidal ideation, adjustment disorder, anxiety, posttraumatic stress disorder, alcohol and drug abuse, and personality difficulties are some common mental health problems seen among military personnel.
Mental Dis. & Gender	Title: The Role of Sexual Assault on the Risk of PTSD among Gulf War Veterans	Authors: HAN KANG, DRPH, NANCY DALAGER, MS, CLARE MAHAN, PHD, AND ERICK ISHII, PHD Source: Anns Epideiological, 2005;15, p.191-195	Military Physicians & Trainers		Using the National Health Survey data the role of sexual harassment and assault as predictors of PTSD symptoms was examined among a population-based sample of female US Gulf War military personnel. The survey population consisted of 15,000 Gulf War veterans and 15,000 non-Gulf veterans	Only 11,441 (76.3%) responded by mail or telephone to the survey and were included in these analyses. Overall, nearly 24% of the females reported a history of sexual harassment and 3.3% of the females reported a history of sexual assault.

Mental Dis. & Gender	The Association between In-Service Sexual Harassment and Post-Traumatic Stress Disorder among Department of Veterans Affairs Disability Applicants	Maureen Murdoch, Melissa A. Polusny, James Hodges, Diane Cowper; MILITARY MEDICINE, 171, 2:166. 2006	Military Policy-makers, Military Physicians & Trainers	Retrospective Study	To describe the association between post-traumatic stress disorder (PTSD) and in-service sexual harassment in a nationally representative sample of Department of Veterans Affairs PTSD disability applicants. 20-page, self-administered questionnaire sent to an eligible pool of 2,466 men and 2,452 women who had previously filed VA PTSD disability claims. Surveys were mailed an average of 2 years after recipients had filed their claims, and almost all claims had been decided.	Findings were consistent with earlier reports linking sexual harassment with PTSD among women. Men showed no association between in-service sexual harassment and PTSD. Among female veterans seeking PTSD disability benefits, reported in-service sexual harassment severity and current PTSD symptom severity had a small but statistically significant association.
Mental Dis. & Social	Title: Time, gender, and regional trends in the application for service-related post-traumatic stress disorder disability benefits, 1980-1998	Authors: Maureen Murdoch, David B Nelson, Larry Fortier. Source: Military Medicine. Bethesda: Aug 2003. Vol. 168, Iss. 8; p. 662	Veterans Affairs	Retrospective Study	180, 039 veterans who filed disability claims between 1980 and 1998 due to post-traumatic stress disorder (PTSD). An assessment made of time, gender, and regional trends in the application and approval rates for Vets.	Research suggested that a Vet's classification, determined eligibility for VA medical services; men's claim approval rates exceeded women's by 12%.



Mental Dis. & Strategy	Title: Disposition Decisions in U.S. Air Force Force Basic Trainees Assessed During Mental Health Evaluations	Authors: Mark A. Staal, Jeff A. Cigrang, Edna Fiedler Source: Military Psychology, 2000, 12(3), 187-203	Military Physicians	Review	To develop empirically derived profiles, from (1,048) trainees assessed at the 6-week Basic Military Training (BMT) course at Lackland Air Force Base, TX, of the 4 trainee disposition groups that distinguished trainees.	Indicated the existence of several key variables in the Air Force basic trainee's profile that may be used by the psychologists for disposition Classification: diagnosis, suicidal intent (self-reporting plans to suicide), a history of physical or sexual abuse (or both), self-reported current impact of that abuse (physical, sexual, or both), past alcohol treatment.
Mental Dis.& Strategy	Mental Health Evaluations of US Air Force Basic Military Training and Technical Training Students	Authors: Capt. David Englert, USAF BSC; Capt Christopher L. Hunter, USAF BSC Source: Military Medicine, November 2003, 168: 904-910	PEB	Restrospective Follow-up Study	looked at the attrition of US Air force basic military trainees and technical school students due to mental health disorders in 2001. 1680 basic trainees and 338 technical school students who were seen at the BAS from January 2001 to December 2001 were used	It was discovered that changes made at the BAS did not lower the # of trainees who finish the program (90%). Autors postulate that self-referral and self-elimination options could save a significant amount of money in future training costs and personnel moves.
N/A	Title: There's Safety in Numbers	Authors: Rosenberg, Mark Source: American journal of preventive medicine, 2000, 18(3 Suppl): 6-7	Researchers & Physicians	Pre-Literature Review	Introduces a series of articles that were published in this issue (and others) of the American journal of preventive medicine addressing the issue(s) of injuries in the military-determining the existence and causes, and prevention methods.	N/A

Physical Dis.	Title: "Disabilities due to injury in the military."	Author: Songer, TJ; LaPorte, RE Source: American journal of preventive medicine, 2000 Apr, 18(3 Suppl):33-40	Military Policy-makers(PEB)	Review	Identified leading causes of disability for each branch; disability cases were categorized into five groups: Permanent disability, Separation with severance pay, Separation without benefits, Temporary disability, Fit for duty	1994 Air Force medical conditions: Orthopedic and musculoskeletal system 22%, Mental Disorder 21%, Neurologic conditions and convulsive disorders 13%, Systemic conditions and respiratory system 14%, Blood/skin/endocrine systems 12%
Physical Dis.	Title: Prior Knee Injury and Risk of Future Hospitalization and Discharge from Military Service	Authors: Cox, Karin, Kathryn Clark, et al., Source: American journal of preventive medicine, 2000, 18(3 Suppl): 112-117	Administrators, PEB	Retrospective Follow-UP Study	Accession data from the Defense Manpower Data Center (DMDC) was used to study individuals entering active duty between January 1995 and December 1996	suggested that Army men with knee waivers are less likely to be retained on active duty. There was a significantly reduced rate of retention (survival) for Army high-risk women
Physical Dis.	Title: Effect of Rest from Running on Overuse Injuries in Army Basic Training	Authors: Popovich, Rose, John Gardner, et al., Source: American journal of preventive medicine, 2000, 18(3 Suppl): 147-155	PEB	Case Study	to prove whether or not modification of running schedules in companies of Army recruits in basic training would prevent stress fractures among recruits.	The results of the study did not demonstrate that resting reduced the incidence of stress fractures, given the wide variation in the amounts of physical training that was observed in recruits.
Physical Dis.	Non-Battle Injury Casualties During the Persian Gulf War and Other Deployments	Authors: Writer, James Source: American journal of preventive medicine, 2000, 18(3 Suppl): 64-70	Military Commanders	Restrospective Study	reviewed injury occurrences & evaluated injury surveillance systems used on deployments of US military personnel in 1994. Data was collected and evaluated during deployments to Hati, Egypt, and Somalia during the Persian Gulf War via (military) administrative databases.	Results of the study showed that injuries were the leading cause of death, hospital admissions, and outpatient visits among troops.

Physical Dis.	Sports and Physical Training Injury Hospitalizations in the Army	Authors: Lauder, Tamara D., Susan P. Baker, et al. Source: American journal of preventive medicine, 2000, 18(3S): 118–128	Military Physicians & Trainers	Restrospective Study	An Army database of all hospital admissions for active duty Army personnel in the 1989–1994 period was used to study injuries resulting from sports and Army physical training.	there were 13,861 hospital admissions for injuries resulting from sports or Army physical training; rates of sports injuries were 38 and 18 per 10,000 person-years for men and women; sports injuries accounted for an average of 29,435 lost duty days each year: Men lost an average of 13 days per injury and women lost an average of 11 days per injury.
Physical Dis.	Title: The etiology of low back pain in military helicopter aviators: Prevention and treatment	Authors: Pelham, Thomas, White, Harold. Source: Work (2005), 24(1) 101-110	Military Physicians & Trainers	Review	No stats measured. Discussed several options to improve in-flight sitting posture	Recommend using a pre and post flight exercise protocol for pilots
Physical Dis.	Title: The natural history and risk factors of musculoskeletal conditions resulting in disability among US Army personnel	Authors: Lincoln, Andrew. Source: Work; 2002, Vol. 18, p. 99-113	Military Policy-makers, Military Physicians & Trainers	Retrospective Study	Study followed active-duty Army personnel from their initial (musculoskeletal) hospitalization, through the development of physical disability, between the years of 1989 and 1996.	Disability rates highest among the following subgroups: 21-25 year olds; enlisted personnel in the lowest pay grades (E1-E3); those in the service for 6 months or 7-12 months

Physical Dis.	Title: “Physical Tasks of Military Occupational Specialties as Risk Factors for Knee-Related Disability Discharge	Authors: Williams, R.E., Amoroso, P. Source: Technical Report, February 2000	Military Policy-makers, Military Physicians & Trainers	Retrospective Study	Examines the relationship between physical demands of military occupations and disabling knee injury among 7,454 (cases and controls selected from the TAIHOD system) men and women in the U.S. Army. The goal of the report is to group military occupational specialties (MOS’s) into a classification system that describes the physical demands of the job.	Results showed that several of the physical task groupings had meaningful trends and associations with disabling knee discharge-maximum weight lifted, pushing/pulling, kneeling, sitting and standing.
Physical Dis.	“Knee-Related Injuries and Disabilities in the U.S Army 1980-1997”	Authors: Sulsky, S., Mundt, K.A. Source: USARIEM Technical Report, August 2000	PEB	Retrospective Study	Report on the use of case-controlled studies on data obtained from the TAIHOD system to identify differences in the determinants of disability outcomes for active duty members.	Found from this study was that the risk of discharge depended on gender, race, and age; and that white women were at higher risk for injury than men and non-white women.
Physical Dis.	Predictors of Low Physical Fitness in a Cohort of Active-Duty U.S. Air Force Members	Anthony S. Robbins, Susan Y. Chao, Vincent P. Fonseca, Michael R. Snedecor, , Joseph J. Knapik; American Journal of Preventative Medicine 2001, 20(2), p. 90–96	Military Policy-makers, Military Physicians & Trainers	Retrospective Study	Study describes the associations between behavioral and demographic characteristics and physical fitness (as measured by submaximal cycle ergometry) in a large cohort (38,837) of ADAF members who underwent testing in 1998–1999.	Results proved that both demographic and behavioral factors play important roles in physical fitness.
Physical Dis. & Compensation	Title: Disability related to the musculoskeletal system: Physical Evaluation Board data”	Authors: Amoroso, P.J., Canham, M.L. Source: Chapter 4 of Atlas of Injuries in the US Armed Forces, January 1999	Military Policy-makers, PEB	Review	reports disability rates, case distributions and costs of disabilities for the Army, Navy/Marines, and Air Force.	Between 1990 and 1994, Air Force disability cases increased 80% to 9/1000 personnel/year.

Physical Dis. & Compensation	Title: Disability evaluation system and temporary limited duty assignment process: A Qualitative Review”	Authors: Keenan, M. Debra, Wilkins, Gail M. Source: Thesis, Naval Postgraduate School, March 1998.	Military Policy-makers, Military Physicians & Trainers	Review	To analyze the factors that contribute to the amount of time a Naval service member spends in a transient and limited duty status for medical reasons.	Found no conclusive reason to explain why the percentage of limited duty and 335 personnel had not decreased relative to the enlisted population force downsizing.
Physical Dis. & Death	Title: “Evaluation Report- Accidental Off-Duty Deaths in DoD”	Authors: Office of the Inspector General Department of Defense, 1998.	Military Policy-makers, Military Physicians & Trainers	Retrospective Study	Focused on 4,698 accidental deaths that occurred during off duty hours from 1988 through 1996 to assess the effectiveness of safety programs by analyzing the overall off-duty accidental death rates over time and by comparing the motor vehicle death rates and civilian deaths (for ages 17 to 40).	Found that accidental off-duty deaths declined from 37 deaths per 100,000 individuals in 1988 to 25.6 deaths (31%) per 100,000 individuals in 1996.
Physical Dis. & Death	Title: Deaths Due to Injury in the Military	Authors: Powell, Kenneth, Lois Fingerhut, et al. Source: American journal of preventive medicine, 2000, 18(3 Suppl): 26-32	Military Policy-makers & Administrators	Retrospective Study	Data from the Department of Defense Directorate of Information was used to examine the death rates of men and women in the services for unintentional injury, suicide, homicide, and illness from 1980-1992.	For USAF: 59% unintentional injury; 22% illness; 15% suicide; 4% homicide

Physical Dis. & Death	Title: Sudden Death in Young Adults: A 25-Year Review of Autopsies in Military Recruits	Authors: Eckart, Robert. E, Scoville, Stephanie, Campbell, Charles L. Source: Annals of Internal Medicine, 2004 141:829-834.	Military Policy-makers, Military Physicians & Trainers	Restrospective Study	To determine causes of nontraumatic sudden death among a cohort of military recruits using demographic data from the DoD Recruit Mortality Registry for military recruits over a 25-year period (1977 through 2001)	Results show that the DoD-RMR contained 277 deaths identified from among 6.3 million recruits from 1977 through 2001. The median age was 19 years (range, 17 to 35 years), and 111 (88%) were male; rate of nontraumatic sudden death was 13.0 per 100 000 recruit-years
Physical Dis. & Death	Traumatic Deaths During U.S. Armed Forces Basic Training, 1977–2001	Stephanie L. Scoville, DrPH, John W. Gardner, MD, DrPH, Robert N. Potter, DVM, MPH; American Journal of Preventative Medicine 2004;26(3)	Military Policy-makers, Military Physicians & Trainers	Retrospective Study	The purpose of this analysis is to provide an epidemiologic description of traumatic recruit deaths from 1977 through 2001; and analyze nontraumatic recruit deaths during the same time period for the Air Force, Navy, Marine Corps, or Army.	Only 28% (77 of 276) of recruit deaths were classified as traumatic (suicide, unintentional injury, and homicide), in comparison to three quarters in both the overall active duty military population and the U.S. civilian population (ages 15–34 years). Of the 28%, the Air Force had the highest suicide incidence rate.
Physical Dis. & Gender	Title: U.S. Air force recruit injury and health study.	Author: Snedecor, MR; Boudreau, CF; Ellis, BE; Source: American journal of preventive medicine, 2000 Apr, 18(3 Suppl):129-40	Military Policy-makers, Military Physicians & Trainers	Case Study	Outpatient visits for female (5250) and male recruits (8656) were collected and analyzed for rate of injury, types of injuries, and risk of injury throughout a 6-week training period.	most common types of injuries among male and female recruits were ankle and foot (747), knee (652), and upper body (540)

Physical Dis. & Gender	Title: High Injury Rates Among Female Army Trainees: A Function of Gender?	Authors: Bell, Nicole, Thomas Mangione, et al., Source: American journal of preventive medicine, 2000, 18(3 Suppl): 141-146	PEB	Case Study	861 trainees were followed during the 8-week basic training courses to investigate the association between gender and risk of exercise-related injuries	Women experienced about twice as many injuries overall as men. Their risk for more serious time-loss injuries was even greater at almost 2.5 times the risk of the male trainees. Most injuries for both genders were to the lower extremity.
Physical Dis. & Gender	Stress fracture injury in young military men and women	Authors: Armstrong III, David W., John-Paul H. Rue, et al. Source: Bone 35 (2004) 806– 816		Case Study	To compare young men and women at the United States Naval Academy who sustained lower extremity stress fracture during a military summer training program with a matched group of uninjured recruits to identify factors that may increase the risk of a stress fracture. (13F 18M subjects) in both groups	found that significant, acute weight loss combined with regular daily physical training among young military recruits may be a significant contributing risk factor for stress fracture injuries in young military men and women.
Physical Dis. & Gender	Title: Military Training-Related Injuries Surveillance, Research, and Prevention	Authors: Kenton R. Kaufman, PhD, Stephanie Brodine, MD, Richard Shaffer, PhD Source: American journal of preventive medicine, 2000;18(3Suppl) 54-63	Military Policy-makers, Military Physicians & Trainers	Review	Reviews epidemiologic literature on musculoskeletal injury rates; injury type and location; and risk factors for military populations; provide some strategies for preventing musculoskeletal injuries via altering the training regimen	Data reviewd suggested that female trainees in any given study experience about twice the incidence of musculoskeletal injury during training as their male counterparts. Evaluation of intervention demonstrated a significant reduction in all overuse type injuries. Lower extremity stress fractures were reduced by 55%, which resulted in 370 fewer stress fractures per year

Physical Dis. & Gender	TITLE: "Gender differences in musculoskeletal injury rates: a function of symptom reporting?"	AUTHOR: SANDRA A. ALMEIDA, DANIEL W. TRONE, DENISE M. LEONE, RICHARD A. SHAFFER, SHERRY L. PATHEAL, and KEN LONG SOURCE: Medicine and Science in Sports and Exercise 31 no12 1807-12 D 1999	Military Physicians & Trainers	Case Study	To determine whether these reporting differences contributed to the higher rates of injury found among female trainees; conducted at Marine Corps Recruit Depot (MCRD) San Diego and MCRD Parris Island; Male subjects (N = 176) & Female subjects (N = 241)	The results of the study showed that for men and women subjects, the majority of reported and unreported diagnoses were overuse injuries, distributed from the knee downward.
Physical Dis. & Gender	Title: Risk factors for occupational knee-related disability among enlisted women in the U.S Army	Authors: Sulsky, S.I, and Mundt, K.A. Source: Occupational Environmental Medicine; 2002, Vol. 59, p601-607	Military Physicians	Case Study	To identify sociodemographic and occupational determinants of knee related disability discharge from the US Army among enlisted women, and investigate effect modification.	
Physical Dis. & Gender	Title: "Predictors of Back Injury Among Women Military Recruits"	Principal Investigator: Michael Weaver Source: Annual Report, U.S Army Medical Research & Material Command, November 1999	Military Physicians & Trainers	Prospective, non-experimental study	1200 female recruits to recommend exercise and educational interventions for reducing the incidence of back injury; identify risk factors for back injury and discomfort	The study was not complete as of the date of the report, so no additional information was provided in this document.



Physical Dis. & Gender	Stress fractures in Female Army Recruits: Implications of Bone Density, Calcium Intake, and Exercise	Alana Cline, Richard Jansen, Chrispothor Melby; Journal of American College of Nutrition, Vol 17(2), 128-135 (1998)	Military Physicians & Trainers	Case Study	The objective of this case-control study was to identify characteristics and factors associated with increased risk for stress fractures in military women. 49 female soldiers with confirmed stress fractures (cases) and 78 females soldiers with no orthopedic injuries (controls); aged 18 to 33 years were recruited from a military installation during 12 week basic training.	The results of the study show that stress fracture in female Army recruits was not correlated with bone density or calcium intake during adolescence; and that there was a weak relationship observed to prior physical activity.
Physical Dis. & Social	Title: Review of Cardiac Events in USAF Aviators	Authors: Sandra Osswald, Ralph Miles, et al., Source: Aviation, Space, and Environmental Medicine. November 1996. Vol. 67(11); p.1023-1027	Military Surgeon General	Case Study	The study was conducted between 1988 and 1992, which included a population average of 33,058 pilots who were grouped by age; to define the cardiac event rate in USAF aviator population & to examine the circumstances surrounding these events.	Results of the study identified 38 cardiac events among active duty USAF pilots, which averaged 7.6 events per year-all were male & majority were from 44-49 years old. average incidence of cardiac events per year over the 5-year period was 2.32/10,000.
Physical Dis. & Strategy	Title: Injury prevention during physical activity in the Australian Defence Force	Authors: Sherrard, J., Lenne, M., Stokes, M. and Ozanne-Smith, J. Source: Journal of Science & Medicine Sports, (2004), 7(1) 106-117	Military Physicians & Trainers	Review	Examined the major findings from a commissioned review of injuries sustained by Australian defense force (ADF) personnel during non-combat military training and sports activities in 2001.	Authors found that the major injury risk factors during military training include older age, female gender, greater amounts of running, low levels of physical activity/sedentary lifestyle, low levels of aerobic fitness/performance, previous injury history, and highly rigorous specialized training.

Physical Dis.& Gender	Title: "Injury and Illness Among Air Force Female Military: Final Report", April 1996.	Authors: Snedecor, M.R., Boudreau, C.F	Military Policy-makers, Military Physicians & Trainers	Follow Up Study	This report preceded the journal article that was published by the authors titled "U.S. Air force recruit injury and health study" [above]	Results concluded that female recruits were at higher risk for injury during basic training, for various reasons that may not be physiologically gender-specific, but more to do with pre-enlistment physical conditioning.
Physical Dis., Gender, & Social	Title: Case–Control Study of Discharge from the U.S. Army for Disabling Occupational Knee Injury The Role of Gender, Race/Ethnicity, and Age	Authors: Sandra I. Sulsky, MPH, Kenneth A. Mundt, PhD, Carol Bigelow, PhD, Paul J. Amoroso, MD, MPH Source: American journal of preventive medicine, 2000;18(3Suppl) 54-63	PEB	Case Study	To determine the separate and joint roles of age, gender, and race/ethnicity differences in the odds of knee-related disability discharge from the Army, as these sociodemographic characteristics are likely to be important variables in future analyses of occupational knee injury.	Non-Caucasians were at lower risk than Caucasians at all ages and among both men and women. The effect of race was consistent over all age groups.
Policy	Title: Women, work and musculoskeletal health	Authors: Strazdins, Lyndall and Gabriele Bammer Source: Social Science & Medicine 58 (2004) 997–1005	Physicians & Policy Makers	Case Study	A mailed self-report survey gathered data from 737 Australian Public Service employees (73% women) to examines gender differences in work-related (civilian) health conditions.	Eighty one per cent reported some upper body symptoms; of these, 20% reported severe and continuous upper body pain.

Policy	Title: The role of human factors engineering in establishing occupational fitness standards	Authors: Kuruganti, U., Rickards, J. Source: International Journal of Industrial Ergonomics 34 (2004) 451–457	PEB	Strategy	Examines the current practices used to develop job task requirements in the traditionally male-dominated occupations of firefighter, police officer and armed forces personnel and the role of task analysis.	In traditionally male-dominated areas such as police officers, firefighters and the armed forces, guidelines were established without considering the possibility of women recruits; and that appropriate task analysis is key to the development of suitable occupational fitness tests.
Policy	Title: Separation or Retirement for Physical Disability	Authors: Blanchard, G. Source: Department of Defense Directive Number 1332.18, November 4, 1996.	Military Policy-makers(PEB)	Review	Updated policy DoD Directive 1332.18 dated February 25, 1986 regarding responsibilities for separation or retirement for physical disability	That members of military should be examined for physical fitness every five years.
Policy	Physical Disability Evaluation	Authors: Hill, A. Source: Technical Report, November 1996	Military Policy-makers & Administrators	Review	Report implements policy, assigns responsibilities, and prescribes procedures under DoD Directive 1332.18 and Title 10, U.S Code for retiring or separating Service Members because of physical disability.	Provides a detailed list of medical and physical conditions which should be referred to the DES [49-72].
Policy	Title: “Method & Actions for Improving Performance of the Department of Defense Disability Evaluation System”	Authors: Marcum, Cheryl, Emmerichs, Robert. Source: Rand National Defense Research Institute, Report, 2002.	Military Policy-makers, Military Physicians & Trainers	Review	Examines how training DES primary participants could help provide more consistent disability evaluation results for similarly situated members of the military services.	Recommended use of a goal fabric analysis, a bottom-up planning tool for identifying actions needed to address a diverse set of issues and organizing those actions into an overall plan

Policy	Title: “Hospitalizations due to injury: Inpatient medical records data”	Authors: Gardner, J.W., Amoroso, P.J. Source: Chapter 5 of Atlas of Injuries in the US Armed Forces, January 1999.	Military Policy-makers, Military Physicians & Trainers	Review	Summarizes hospitalization rates and trends, injury hospitalizations relative to other diagnosis, and injury hospitalizations by external cause of injury	Between 1980 and 1994, the Air Force hospitalization rate declined 35% to 100/1,000 personnel/year; musculoskeletal conditions, were frequently the result of injuries, and the leading cause of hospitalizations for all branches except the Air Force; digestive conditions accounted for the largest proportion of hospitalizations in the Air Force in 1994.
Policy	Reducing medical attrition: The role of the accession medical standards analysis and research activity	Kathryn L Clark; Ramy A Mahmoud; Margot R Krauss; Patrick W Kelley; et al Military Medicine; Jul 1999; 164, 7, pg. 485	Military Policy-makers, PEB	Review	Discusses the Accession medical Standards Steering Committee which serves to integrate the medical and personnel communities so that they could provide policy guidance and establish standards for accession requirements	Since its inception, AMSARA has enabled the committee to evaluate current databases, which have lead to important findings and future research
Policy	The focus on women veterans who use Veterans Administration Health Care: The Veterans Administration Women’s Health Project	Katherine M Skinner; Joan Furey Military Medicine; Nov 1998; 163	Military Policy-makers	Case Study	Study was designed to describe the health-related quality of life of women who received ambulatory care from July 1, 1994 to June 30, 1995. Data was collected via a self-administered mailed survey.	Results of the study found that veteran women scored lower on all scales compared to non-veteran women.

Policy & Strategy	Title: The Use of Existing Military Administrative and Health Databases for Injury Surveillance and Research	Authors: Lincoln, Andrew, Smith, Gordon. Source: American journal of preventive medicine, 2000 Apr, 18(3 Suppl):8-13	Military Policy makers	Review	No stats measured.Discussed the inconsistencies in how data is collected when injuries occur in the military	Made recommendations for coding injuries sustained by personnel
Policy & Strategy	Title: Viewpoint: A Comparison of Cause-of-Injury Coding in U.S. Military and Civilian Hospitals	Authors: Amoroso, Paul J., Bell, Nicole S., Smith, Gordon S. et al Source: American journal of preventive medicine, 2000 Apr, 18(3 Suppl):164-173	Military Policymakers	Review	Describe the STANAG system, subjectively discuss its strengths and weaknesses relative to the ICD-9-CM (system used by civilian hospitals) and draft ICD-10-CM systems of external cause of injury coding	Policy recommendations made about future coding of military injuries applicable to the full spectrum of injury severity including fatalities, hospitalizations, and outpatient visits.
Strategy	Title: COHORT: An Integrated Information Approach to Decision Support for Military Subpopulation Health Care	Authors: Lt Col G. D. "Rick" Reichard-Chief, Health Modeling & Informatics Division: Air Force Medical Operations Agency Source: Presented at the International Command and Control Research Symposium 2004. (ICCRS)	Military Policy makers(PEB)	Strategy	Purpose of the system is to enable the USAF Surgeon General to collect medical data from various military health care facilities for the analysis and early detection of health issues-epidemics, disease trends in specific cohorts of personnel, in real time.	Information obtained from this system will allow authorities to strategize and respond in a timely manner to health issues among deployed men and women.

Strategy	Title: Injuries in the Military: A Review and Commentary Focused on Prevention	Authors: Bruce Jones, Dennis M. Perrota, et al. Source: American journal of preventive medicine, 2000 Apr, 18(3 Suppl): 71-80	Physicians & Policy Makers	Review	Reviews the types and categories of military morbidity and mortality data examined by the Armed Forces Epidemiological Board (AFEB) work group and the companion Department of Defense (DoD) Injury Surveillance and Prevention Work Group.	As a strategy to address these issues, the group chose a five-step public health approach, which was adapted from other researchers, as a framework for the evaluation of military medical information.
Strategy	Title: "Injury Prevention in the US Army, A Key Component of Transformation"	Authors: Lt. Colonel Terry Walters Source: Strategy Research Project, US Army War CollegeOffice of the Inspector General Department of Defense, 2002.	Military Policy-makers, Military Physicians & Trainers	Review	To prove via literature review and survey, over a two year period from 1999 to 2001, that an automated injury surveillance system that provided simple unit injury rates to unit commanders would increase injury awareness and would increase use of existing injury prevention resources.	Results of this experiment combined with a survey of Army War College students to examine leaders' attitudes concerning injuries, explicate some of the institutional barriers affecting injury prevention in the US Army.

## APPENDIX D Summaries of Literature for Special Operations

Table D-1. Summaries of literature for special operation.

The Burden of Disability Among Active Duty Air Force members - AF Special Operations					
Title	Reference	Audience	DOE	Statistics Measured	Findings
US Air Force Special Operations	Kamps Charles T. (2005). <i>Air &amp; Space Power Journal</i> . Vol. 19(1), 19.	Military Policy-makers(PEB)	Review	None	Article describes the duties and responsibilities of the AFSOC.
Mission Possible	Seydel, Captain Carie A. (2003). <i>Airmen</i> . February 2003. Vol. 47(2), 30-36.	Military Policy-makers(PEB)	Review	None	Reports on the advanced skills training of the U.S. airmen for the aircraft combat controllers; responsibility of a combat controller; duration and goals of the training.
Special Ops Accident Surge Prompts Fixes	Wall, Robert (2002). <i>Aviation Week &amp; Space Technology</i> . Vol 157(15), 54.	Military Policy-makers & Administrators	Review	Number of aircraft accidents in 2001	Reports an increase in aircraft <i>accidents</i> among AFSOC during 2001. Improvements have been made to aircrafts (installation of flight data recorders; and training modifications to prepare for extreme environments.
Guts, Glory, and the Warrior Spirit: What sets the toughest airmen apart.	Glenn, Mike. <i>Air Force Times</i> . April 2000, Vol 60(39)14.	Military Policy-makers, Military Physicians & Trainers	Review	None	Provides an overview of the job of pararescuemen and combat controllers of the US Air Force; and a description of training and work in a pararescue field.
Military recruiters lure extreme sports thrill seekers.	Vanden Brook, Tom. <i>usatoday</i> . May 2006.	Military Policy-makers, Military Physicians & Trainers	Review	Discusses recruitment shortages in the AFSOC.	In 2002 the USAF needed 426 combat controllers-it had 350. A full complement of pararescuers was 123- there were 90.

Special tactics training tests body, mind	Vanden Brook, Tom. usatoday. May 2006.	Military Policy-makers, Military Physicians & Trainers	Review	Discussess specifics of special operations training	About one in four drop out during initial training. 30% are lost in the combat controller's apprentice course.
Musculoskeletal injuries in an Army Airborne Population.	Potter, Robert, N (2002). <i>Military Medicine</i> . Vol 167(12), 1033-1040.	Military Surgeon General	Case Study	One-year study conducted among 1,965 members of the 82nd Airborne Division to quantify musculoskeletal injuries and determine their cause(s)	The sample cohort experienced 508 overuse injuries, including 38 stress fractures/reactions. Stress fractures accounted for 7.5% of all over use injuries; injuries resulted in 22,041 limited duty days.
Wanted: Tough Guys. Air Force Times.	Poindexter, G.W. August 1994, Vol 55(1), 6.	Military Policy-makers, Military Physicians & Trainers	Review	Discusses shortages in the AFSOC; and describes the training sessions in detail.	Women are not allowed to compete for positions within the AFSOC because the job involves the potential for ground combat
Health assessment of U.S. Army Rangers	Deuster, Patricia A (2003). <i>Military Medicine</i> . Vol 168 (1), pg. 57-62.	Military Policy-makers, Military Physicians & Trainers	Case Study	Conducted a health assessment (survey) of 38 US Army Rangers to collect information to be used by healthcare professionals for making recommendations about future desirable behaviors.	A diet high in fat (38% of energy), and low in carbohydrates (41.9%) and protein in take (17.9% of energy), was consistent with recommendations for endurance and strength training athletes; 76% of the volunteers reported using alcohol on a regular basis, and 52.6% used some form of tobacco.



Military Training-Related Injuries Surveillance, Research, and Prevention	Kenton R. Kaufman, PhD, Stephanie Brodine, MD, Richard Shaffer, PhD. American journal of preventive medicine, 2000;18(3Suppl) 54-63	Military Policy-makers, Military Physicians & Trainers	Review	Reviews epidemiologic literature on musculoskeletal injury rates; injury type and location; and risk factors for military populations; provide some strategies for preventing musculoskeletal injuries via altering the training regimen	Data reviewed suggested that female trainees in any given study experience about twice the incidence of musculoskeletal injury during training as their male counterparts. Evaluation of intervention demonstrated a significant reduction in all overuse type injuries. Lower extremity stress fractures were reduced by 55%, which resulted in 370 fewer stress fractures per year
Pararescuemen numbers low.	Rolfen, Bruce. <i>Air Force Times</i> . May 2004, Vol 64(44), 30.	Military Policy-makers, Military Physicians & Trainers	Review	Deals with the shortfall in <i>pararescuemen</i> facing the U.S. Air Force; reason behind the shortfall; and changes in the <i>pararescuemen</i> career field.	Approximately 75 graduates are needed annually to meet the Air Force's goals, yet only about 45 students get through the course.
Overburdening special ops	<i>Air Force Times</i> . February 2003, Vol 63(31), 52.	Military Policy-makers	Review	Describes the DoD's plan of deploying <i>special</i> operations units which will overburden the force.	None

## **APPENDIX E PUBLICATIONS**

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### **Preliminary Analysis on Taxonomy and Trends on Disability among Military Forces**

Paper presented at the IIE Annual Conference and Exposition, May 20-24. Orlando, FL.

# **Preliminary Analysis on Taxonomy and Trends on Disability among Military Forces**

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Disability is a major concern for administrators in military services, due to its affect on the availability of active duty and reserve personnel for combat and/or military missions. Physical disability that results in discharge from service results in increased use of medical care, and considerable compensation costs. For active duty military personnel, disability can be most viewed from two perspectives—whether its impact is permanent or temporary. This paper discussed the issue based on the available statistics data gathered on the subject matter by performing a thorough review of literature pertaining to disability within the Air Force; to identify the key causes of injuries among Air Force personnel that result in disability discharge; and to determine the prominent types of injuries including their classification.

Keywords: Disability taxonomy, Air Force, Disability trends

## **1. Introduction**

Disability is classified by the Physical Evaluation Board (PEB) as Permanent disability, which is a permanent and stable disability resulting in discharge with full compensation for life; separation with severance pay, which is disability resulting in discharge with a one-time separation payment; separation without benefits, which is disability resulting in discharge, the disability existed prior to service and was not aggravated by service, or occurred as a result of intentional misconduct or neglect; temporary disability, a medical disability that could improve (or worsen) over time, to be re-evaluated every 18 months; but not fit for active duty; and fit for duty, where the service member can return to active duty [2]. The Air Force further groups disability by class A through C. Class A leading to permanent total disability, Class B leading to permanent partial disability, and Class C resulting from lost work day.

Between 1990 and 1995, there has been an increase in the number of disability cases handled by the PEB. For the Air Force, the rate of disability cases reviewed increased by 49% from 6.9 per 1000 personnel in 1990 to 10.3 in 1995 [2]. The majority of cases reviewed during this time frame included temporary disability, which accounted for 23% of cases; and 41% regarded fit for duty. The results of the study showed that impairments from orthopedic and musculoskeletal conditions were the leading factors accounting for 22% of disability cases reviewed by PEBs in the service. Other causes of disability claims within the Air Force include mental disorders, neurological conditions and convulsive disorder, systemic conditions and respiratory system, and blood/skin/endocrine systems.

One study, which was published in the American Journal of Preventive Medicine in April 2000, was performed to assess the types, rates, and risks of injury for male and female USAF recruits during basic training. The researchers found that female recruits were injured twice as often as male recruits, and were 1.5 times likely to be removed from their training cohort for injury [3]. According to this study, the most frequent reasons for medical discharge, which included both men and women recruits, were knee injury and genetic conditions. More recently, according to data obtained from the Mishap Statistics Scoreboard, for the past five months—from October 2004 to March 2005—the most common Class A disability claims were filed due to ground injuries; next were Class B weapons injuries; then Class B ground injuries; and finally, aircraft fatalities [4].

Compensating disabled service members has been an area of immediate interest to administrators in the services. In the previously mentioned study, it was found that from 1980 to 1990, compensation expenses ranged from \$1.2 billion to \$1.5 billion in direct payments each year [2]. Individuals with permanent disabilities, who are compensated for life, account for the bulk of this expense, as opposed to individuals with temporary disabilities, who are compensated for a maximum of 5 years.

## **2. Taxonomy to Classify Disability**

The first step in beginning research in this area was to define the term “disability” as it relates to the United States military and to determine whether or not each branch had a unique interpretation of it. (start with actually providing definition of disability or lack thereof) It was discovered that the federal government uses the interpretation of the *American Disabilities Act* to classify disability; and according to the ADA’s nondiscrimination standards, under section 501 of the Rehabilitation Act of 1973, the term disability is defined as:

- (1) A physical or mental impairment that substantially limits one or more of the major life activities of [an] individual;
- (2) A record of such an impairment; or
- (3) Being regarded as having such an impairment.

A qualified individual with a disability is "an individual with a disability who satisfies the requisite skill, experience, and education and other job-related requirements of the employment position...and who, with or without reasonable accommodation, can perform the essential functions of the job." [7] The Atlas of Injuries in the U.S Armed Forces, categorized disability cases into five groups [2]:

- Permanent disability—a permanent and stable disability resulting in discharge with full compensation for life.
- Separation with severance pay—disability resulting in discharge with a one-time separation payment.
- Separation without benefits—disability resulting in discharge, the disability existed prior to service and was not aggravated by service, or occurred as a result of intentional misconduct or neglect.
- Temporary disability—a medical disability that could improve (or worsen) over time, to be re-evaluated every 18 months; not fit for active duty.
- Fit for duty—return to active duty.

However, in order to be eligible for disability compensation by the federal government, disability is further defined by each organization's benefits program: Social Security Administration (SSA,) and Veteran's Affairs (VA). A person is considered disabled under Social Security rules if he or she cannot do work that was performed prior to injury, and SSA decides that said person cannot adjust to other work because of his or her medical condition(s). The VA pays veterans Disability Compensation for disabilities that are a result of military service, as long as they meet the following conditions:

- You were injured while you were in the service, or
- You are permanently and totally disabled and you believe that it is because of your military service, or
- You were seriously ill while you were in the service, and you believe you have continuing problems, or
- You developed a mental or physical condition that you believe may be related to your military service.

For simplicity, the definition from each organization was combined in order to create a more detailed set of criteria to determine disability eligibility for the USAF.

### **3. Classification of Types of Injuries:**

There is very little up to date (research) literature that address the trends in active military personnel becoming injured and filing for disability compensation. Thus far, the research found supports studies that were performed in the 1980's and 90's. However, the "Mishap Statistics Scoreboard," which is produced monthly by Combat Edge, and provides statistics on the types of injuries that occurred to enlisted service personnel dating from December 2001-March 2005. The research articles that have been reviewed thus far regarding disability among Air Force members, suggest that the majority of injuries/illnesses related to claims stem from musculoskeletal, psychological (mental and neurological), and social (gender and classification) factors. Research found that death was also a very important factor to consider, but there was uncertainty about whether to classify it by itself or among the other three.

Powell, *et. al.* (2000) discusses the types of injuries that cause the death of military personnel. The researchers used data from the Department of Defense Directorate of Information, and examined the death rates of men and women in the services for unintentional injury, suicide, homicide, and illness from 1980-1992. During this time period, injuries accounted for 81% of all non-hostile deaths among active duty personnel in the Armed Services. The proportion of deaths caused by injuries in the Air Force was 78%. Unintentional injuries accounted for well over half the deaths in each service, ranging from 59% in the Air Force to 71% in the Marine Corps. [11]

**Musculoskeletal:** In determining the existence and size of the problem, the authors of “Injuries in the Military: A Review and Commentary Focused on Prevention,” state that accidental (unintentional) injuries remain the most significant health problem for all three branches of the military services [9]. After reviewing the statistics provided in this article for each service branch, it appears that the USAF had the lowest death, disability case evaluations, and hospitalizations at that time. In the early 1990’s, disability due to injury and disease cost the military services \$1.5 billion annually. The USAF disability case evaluation rate was the lowest, at about 10 per 1000 per year; 52 deaths per 1000 personnel per year; and 97 hospitalizations per 1000 per year. Although few studies have been done to examine the injury rates of recruits for the USAF, research used in Snedecor’s study indicated that training-related injuries were the number one cause of morbidity and limited duty due to medical restrictions in other service organizations. For the most part, research used in this study agreed that the less fit a person is, the greater the risk of injury during training. The most prevalent types of injuries among male and female recruits, classified as musculoskeletal injuries, were ankle and foot (747), knee (652), and upper body (540). Non-injury encounters included respiratory, psychological, and dermatological conditions. The results of the study showed that female recruits were at an increased risk for injury, compared to men, for all categories of injuries examined.

**Psychological Factors:** Little research has been uncovered thus far that describes the mental and neurological disabilities that effect military personnel. Snedecor’s study also showed that psychological factors, in addition to medical (relating to musculoskeletal) were the top two reasons for both male and female trainees. The study did not address whether or not recruits who are discharged during basic training for medical and/or psychological reasons are eligible for disability compensation.

One study performed by Murdoch (2003) examined the trends in the application and approval rates for Veterans Affairs who filed disability claims between 1980 and 1998 due to post-traumatic stress disorder (PTSD)[7]. Post-traumatic stress disorder is a term that describes psychological and emotional distress that develops following a stressful, traumatic event or series of events (i.e., war). The study was conducted on 180, 039 veterans who filed during this time period. According to the author, PTSD is now the most common psychiatric condition for which veterans seek service connection, and in 1998 the Veterans Benefits Administration paid about \$1.1 million each month in compensation to veterans with service-related PTSD. [7] Another study performed by Kozaric-Kovacic and Borovecki (2005) explored the prevalence of psychotic symptoms among Croatian war veterans with combat-related PTSD. According to the authors, a recent epidemiological survey indicated that approximately 80% of individuals with PTSD meet criteria for at least one psychiatric diagnosis. The most frequent diagnoses are major depressive disorder, other anxiety disorders, substance abuse, somatization, personality disorders, and dissociative disorders. [10]

**Social Factors:** Other research has uncovered that lifestyle, gender, genetic conditions, and even service classification; although less common instances of disabilities in active duty USAF officers can also have an effect on the decision-making process regarding policies in disability claims. According to “ Review of Cardiac Events in USAF

Aviators,” cardiovascular diseases have been, and still is, a significant cause of morbidity and mortality in the U.S. The study was conducted between 1988 and 1992, which included a population average of 33,058 pilots who were grouped by age. The results of the study identified 38 cardiac events among active duty USAF pilots, which averaged 7.6 events per year. The information obtained from this study suggests that age and cardiac risk factors are related; and could be used to select subsets of the USAF population who are at higher risk of experiencing heart disease for monitoring.

Murdoch’s research suggested that a Veteran’s classification, whether or not he or she was documented as having a “service-connected” disability, determined if she would be eligible for VA medical services. To the extent that lack of service connection reduced the claimant’s odds of eligibility. [7] The study found that rates of service connection for PTSD for combat-injured men and women were 89 and 92%; and for men women without combat injuries, rates were 44% and 39%. More claims were filed during and beyond the post-Vietnam eras. The United States Navy had the largest observed rate of claims, which averaged 93%; the USAF was second, with an 89% average.

In addition to service classification, gender was another factor that influenced the approval rates of Veterans. His research for this study, based on internal audits of PTSD claims, suggests that women Veteran’s claim approval rates may be lower than men’s. Results found that men’s claim approval rates exceeded women’s by 12%. During this time period, 16.9 % of male, and 6.5 % of female USAF veterans filed for disability.

Bell’s (2000) study investigated the association between gender and risk of exercise-related injuries among Army basic trainees given the same physical fitness activities and environment. 861 trainees were followed during the 8-week basic training courses. The results of the study showed that men entered into the program with significantly higher fitness levels than women on all measures except flexibility. Women experienced about twice as many injuries overall as men. Their risk for more serious time-loss injuries was even greater at almost 2.5 times the risk of the male trainees. Most injuries for both genders were to the lower extremity (musculoskeletal).

#### **4. Statistical Trends of Injury Types & Disability among Active Air Force Members**

The Air Force Law Review states that “civilian Air Force employee may not be required to see an active duty Air Force doctor, or a civilian doctor employed by the Air Force as a civilian employee or contractor,” in order to obtain a diagnosis of mental disability [1]. There is the risk of employees being inaccurately diagnosed, by the employee not providing information from a certified USAF physician, thus, creating an illegitimate disability claim.

The research articles that have been reviewed regarding disability among Air Force members, suggest that the majority of injuries/illnesses related to claims stem from musculoskeletal, psychological (mental and neurological), and social (gender and classification) factors. According to Songer (2000), between 1990 and 1995, there was an increase in the number of disability cases handled by the physical examination boards (PEB) of each military service organization. For the Air Force, the rate of disability cases reviewed increased by 49% from 6.9 per 1000 personnel in 1990 to 10.3 in 1995. [2] The distribution of cases presented to the PEB in 1994, showed that only 23% of

cases were for temporary disability claims; and the majority of cases, 41%, were fit for duty. His research further described the leading causes of disability, as coded by the Air Force PEB. Orthopedic and musculoskeletal conditions were the leading factors for disability cases in all of the services in that same year. For the Air Force, medical conditions were coded as follows: Orthopedic and musculoskeletal system 22%, Mental Disorder 21%, Neurologic conditions and convulsive disorders 13%, Systemic conditions and respiratory system 14%, and Blood/skin/endocrine systems 12%.

In 1996, the Armed Forces Epidemiological Board (AFEB) group issued a report that cited injuries as the leading cause of morbidity and mortality among military service members. [9] They too recognized a need for systematically reducing injuries and other health related issues among service men and women. As a strategy to address these issues, the group chose a five-step public health approach, which was adapted from other researchers, as a framework for the evaluation of military medical information. The five steps include (1) determine the existence and magnitude of the problem, (2) identify causes of the problem. (3) determine what prevents the problem,(4) implement prevention strategies and programs, and (5) continue surveillance.

In determining the existence and size of the problem, the authors state that accidental (unintentional) injuries remain the most significant health problem for all three branches of the military services [9]. In examining the statistics provided in this article, it appears that the USAF had the lowest death, disability case evaluations, and hospitalizations at that time. In the early 1990's, disability due to injury and disease cost the military services \$1.5 billion annually. The USAF disability case evaluation rate was the lowest, at about 10 per 1000 per year; 52 deaths per 1000 personnel per year; and 97 hospitalizations per 1000 per year.

Although few studies have been done to examine the injury rates of recruits for the USAF, research used in Snedecor's study indicated that training-related injuries were the number one cause of morbidity and limited duty due to medical restrictions in other service organizations. For the most part, research used in this study agreed that the less fit a person is, the greater the risk of injury during training. The most prevalent types of injuries among male and female recruits were ankle and foot (747), knee (652), and upper body (540). Non-injury encounters included respiratory, psychological, and dermatological conditions. The results of the study showed that female recruits were at an increased risk for injury, compared to men, for all categories of injuries examined.

In looking at the reasons for discharge from training, the study also showed that medical and psychological factors were the top two reasons for both genders. Furthermore, 55% of men were discharged due to physical injuries (knee, back, etc.), compared to 46% of women. Women were discharged more frequently for non-injury reasons, which included genetic disorders and allergies. The study did not address whether or not recruits who are discharged during basic training for medical and/or psychological reasons are eligible for disability compensation.

The aim of one study performed by Murdoch (2003) was to examine the social factors that affect Veteran's rate of approval, specifically his or her service classification, and gender. The study assessed time, gender, and regional trends in the application and



approval rates for Veterans Affairs who filed disability claims between 1980 and 1998 due to post-traumatic stress disorder (PTSD)[7]. Post-traumatic stress disorder is a term that describes psychological and emotional distress that develops following a stressful, traumatic event or series of events (i.e., war). The study was conducted on 180, 039 veterans who filed during this time period. According to the author, PTSD is now the most common psychiatric condition for which veterans seek service connection, and in 1998 the Veterans Benefits Administration paid about \$1.1 million each month in compensation to veterans with service-related PTSD. [7]

During this time period, research suggested that a Veteran's classification, whether or not he or she was documented as having a "service-connected" disability, determined if she would be eligible for VA medical services. To the extent that lack of service connection reduced the claimant's odds of eligibility. [7] In addition to service classification, other factors that influenced the approval rates of Veterans were the region in which the claims were filed-where approval rates ranged from 36% to 74%- and gender. Murdoch's research for this study, based on internal audits of PTSD claims, suggests that women Veteran's claim approval rates may be lower than men's.

Results of this study found that men's claim approval rates exceeded women's by 12%. During this time period, 16.9 % of male, and 6.5 % of female USAF veterans filed for disability. The "time trends" aspect of the study showed that a small number of veterans filed between 1980 and 1983. However, from 1984 on, applicant rates increased geometrically, peaking at 25, 679 in 1998. [7] The study found that rates of service connection for PTSD for combat-injured men and women were 89 and 92%; and for men women without combat injuries, rates were 44% and 39%. More claims were filed during and beyond the post-Vietnam eras. The United States Navy had the largest observed rate of claims, which averaged 93%; the USAF was second, with an 89% average.

## **5. Preliminary Recommendations and Conclusions**

Tracking the medical data from various military health care facilities is one strategy that may work for how the USAF collects and examines data regarding frequency and trends of disability among active duty officers. The Composite Occupational Health & Operational Risk Tracking (COHORT) system was presented at the International Command and Control Research Symposium (ICCRS) in 2004, by representatives of the USAF medical community.

The purpose of the COHORT-Composite Occupational Health & Operational Risk Tracking- system is to enable the USAF Surgeon General to collect medical data from various military health care facilities for the analysis and early detection of health issues-epidemics, disease trends in specific cohorts of personnel, in real time. [5] The objectives of this system will be to monitor data in two categories- prospective and retrospective epidemiological data. A prospective study will identify personnel who are at risk for experiencing a particular event. A retrospective study will identify persons who have actually experienced the event. The system links military Integrated Clinical Databases (ICDB) around the world, into one centralized database. And as information is updated in the local systems, the COHORT system will update as well. Information obtained from this system will allow authorities to strategize and respond in a timely manner to health issues among deployed men and women.

From a research standpoint, this system could prove to be a very effective method of compiling accurate and relevant data that is necessary for addressing the demands of this type of research. Furthermore, several testimonies have been heard before the Subcommittee on National Security, Emerging Threats, and International Relations in 2003, on protecting the health of deployed forces, which support the implementation of the aforementioned surveillance system to generate data on deployed forces.

The Armed Forces Epidemiological Board (AFEB) work group considered a number of interventions that could alleviate the injuries that military personnel were experiencing. For instance, reduced running mileage in physical training exercises could reduce knee and ankle injuries. In the mid-1980s, Army research suggested that above certain thresholds of physical training, injury rates increased but fitness did not [9]. The AFEB 's strategy further supports the need for surveillance and monitoring of activities in order to identify health problems and prioritization of prevention methods.

## **6. Acknowledgement**

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